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ABSTRACT

This curriculum guide, one of six modules keyed to the building maintenance competency profile developed by industry and education professionals, provides materials for two units on grounds maintenance equipment and procedures. The first unit deals with grounds maintenance equipment and includes the following lessons: safety; changing oil/filter and servicing breather; ignition systems; basic maintenance; fuels; and air filter and cooling systems. In the second unit, on grounds maintenance procedures, are the following lessons: mow and trim grass; pruning trees, shrubs, and vines; seeding/sodding grasses; mix, apply, and store fertilizer; weed control; and mix, apply, and store pesticides. Each lesson includes some or all of the following color-coded components: performance objectives, information sheets, transparency masters, handouts, assignment sheets, job sheets, lesson tests, and answer key. (YLB)

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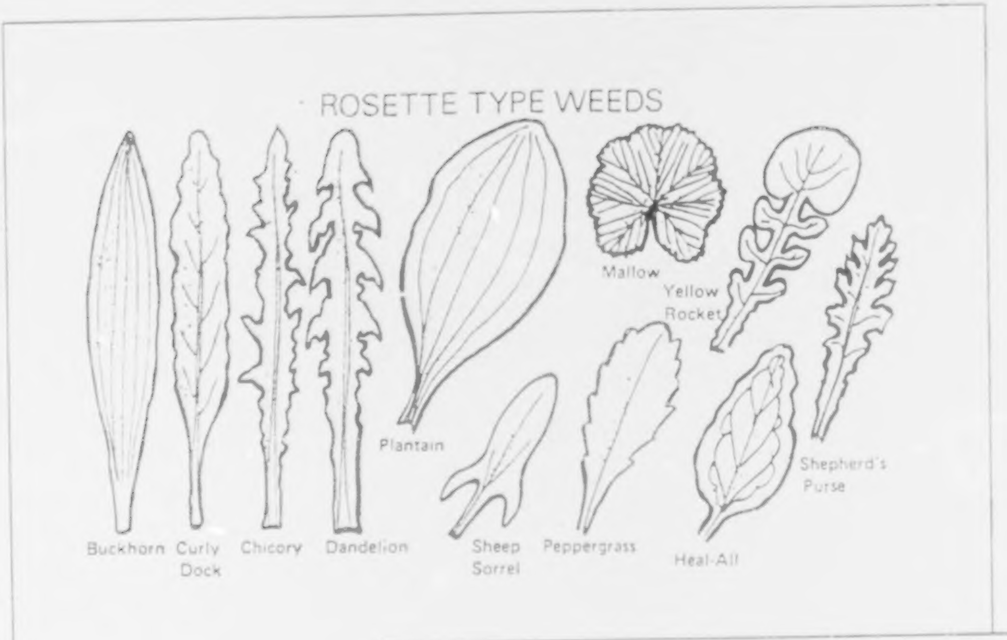
Instructor's Guide


ROSETTE TYPE WEEDS
Buckhorn
Curly Dock
Chicory
Dandelion
Plantain
Sheep Sorrel
Peppergrass
Mallow
Yellow Rocket
Heal-All
Shepherd's Purse

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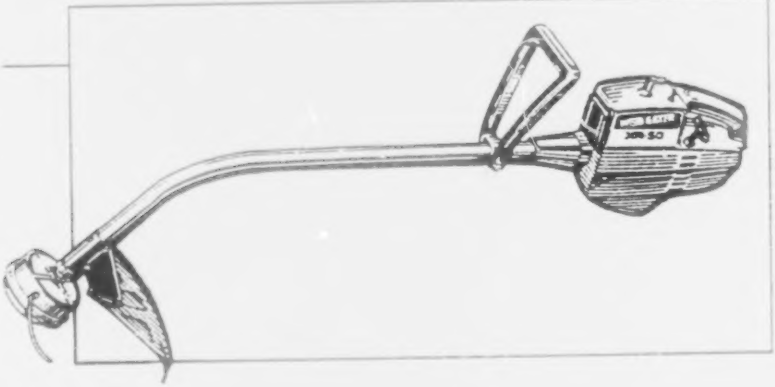

Module VI

Grounds Maintenance Equipment and Procedures

BUILDING MAINTENANCE

Produced by Instructional Materials Laboratory
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BUILDING MAINTENANCE

Module VI: Grounds Maintenance Equipment and Procedures

prepared by

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June 1990

Instructor's Guide
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FOREWORD

We are indebted to the teachers and administrators who have provided their time, effort and professionalism to the development of this guide. This guide is an outstanding example of what can be accomplished when the right people with the right attitude get together. The curriculum writers and subject matter experts who worked on this guide are to be commended for a job well done.

The Vocational Instructional Management System (VIMS) has become Missouri's framework for competency-based instruction; therefore, the Building Maintenance Curriculum Guide is designed to be totally integrated with the VIMS system. A curriculum guide is more than a resource--it is an integral part of the management system. Its purpose is to guide and facilitate competency-based instruction to help classroom teachers manage instruction.

The format of this guide has been set up for competency-based teaching and testing. Unit tests evaluate specific competencies and can be used with the Vocational Administrative Management System (VAMS). All information sheets, transparency masters, job sheets, assignment sheets and test items are keyed to specific competencies. A cross reference table has been included to quickly identify parts of the curriculum that relate to specific competencies. The material has also been packaged for students.

Competencies are stated prior to instruction and the student knows what the basis for evaluation will be. Each student is thus held responsible for mastering the competencies. The basis for grading is attainment of competencies rather than measurement against other students.

Although this guide may be a new format and new system for many teachers, we are confident that, when used as designed, time spent by teachers and students will become more productive. Any future building maintenance curriculum modifications will begin with this guide. We will evaluate the need to update this guide on a module-by-module basis. Your suggestions regarding areas for improvement are both encouraged and appreciated.

Judith Moore, Supervisor
Industrial Education
Department of Elementary and Secondary Education

Chuck Waibel, Director
Industrial Education
Department of Elementary and Secondary Education

ACKNOWLEDGMENTS

This building maintenance guide represents a continuing commitment to Missouri's Vocational Instructional Management System (VIMS). The guide has been keyed to the building maintenance competency profile developed by industry and education professionals in the state.

When searching for current building maintenance materials to adopt or utilize in the guide's development, comparable materials were found from the Occupational Curriculum Laboratory of East Texas State University and the Curriculum and Instructional Materials Center of Stillwater, Oklahoma. These materials have been utilized as a resource for this guide. A debt of thanks is owed to the Occupational Curriculum Laboratory and the Curriculum and Instructional Materials Center for the research and development of these building maintenance materials.

These educators contributed to the guide as members of the advisory and fieldtest committees:

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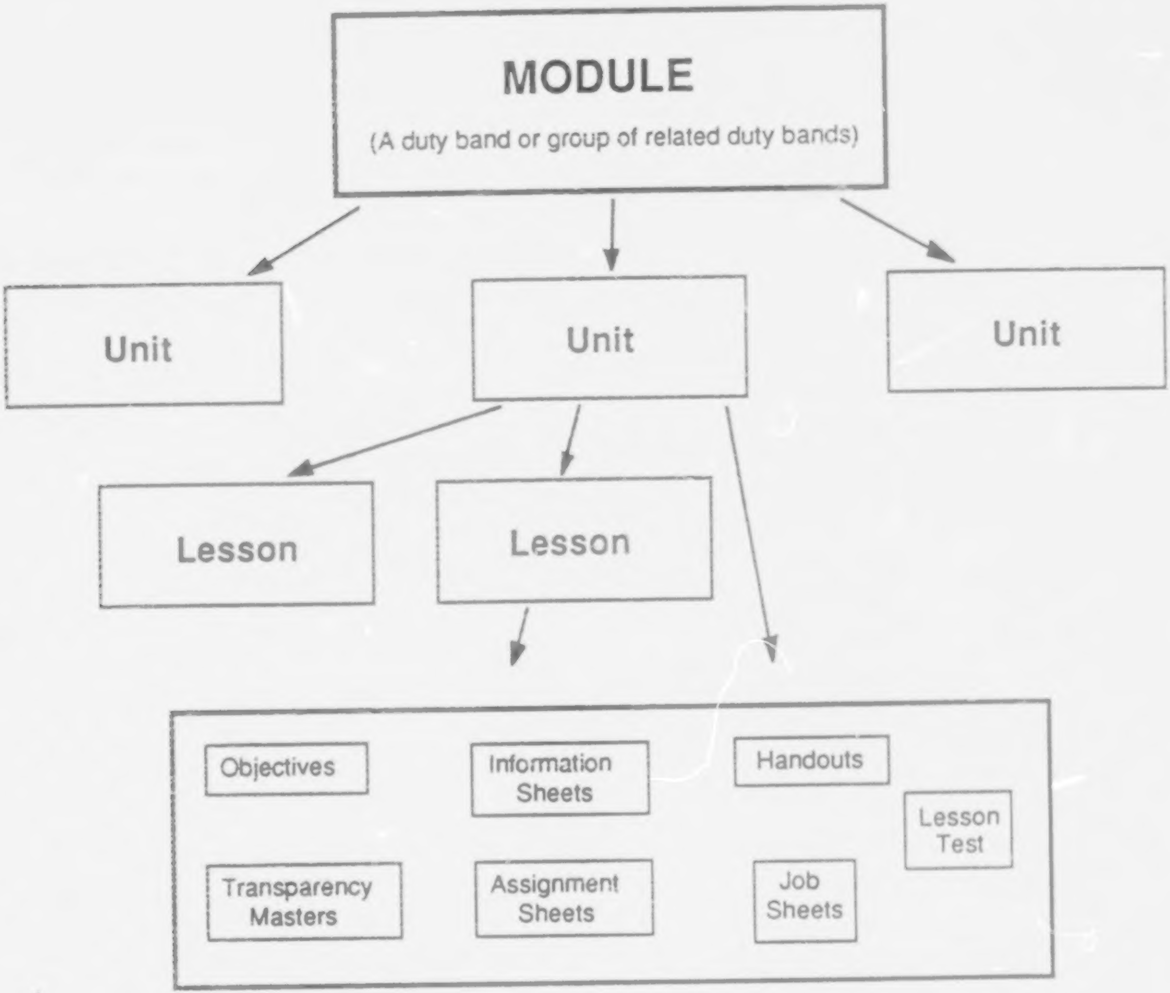
HOW TO USE THIS PUBLICATION

GUIDE COMPONENTS

Units of Instruction

This Building Maintenance guide contains six modules of instruction. Within each module are instructional units including some or all of the following components: performance objectives, information sheets, transparency masters, handouts, assignment sheets, job sheets and lesson tests.


MODULE
(A duty band or group of related duty bands)
Unit
Unit
Unit
Lesson
Lesson
Objectives
Information Sheets
Handouts
Lesson Test
Transparency Masters
Assignment Sheets
Job Sheets

Competency profile

On the Missouri competency profile, tasks are divided into general subject areas, or duty bands, which are identified by a capital letter. Under each duty are related tasks (competencies), which are identified by an Arabic numeral. To evaluate the student's performance of the competencies, a 3-2-1-N grading system is used where:

3 = **Mastery**--can work independently with no supervision
2 = **Requires supervision**--can perform job completely with limited supervision
1 = **Not mastered**--requires further instruction and close supervision
N = **No exposure**--no experience or knowledge in this area

Cross-reference table (color-coded white)

Once the numbering system is understood, this table quickly reveals how the instructional components of the module relate to Missouri competencies. On the competency profile, tasks are divided into general subject areas, or duty bands, which are identified by a capital letter. Under each duty band are related tasks (competencies), which are identified by an Arabic numeral.

On the cross-reference table, unit numbers are represented by Roman numerals (I, II, III, etc). Other components of the module (transparencies, handouts, assignment sheets and job sheets) are shown with Arabic numerals. By looking at the cross-reference table, the instructor can quickly determine what test questions or job sheets a student needs to receive an evaluation for on a particular competency.

Objectives (color-coded white)

Each unit is based on performance objectives which state the measurable unit and specific behavioral or performance objectives that students are expected to achieve. Since the objectives of the unit provide direction for the teaching-learning process, it is important for the teacher and students to have a common understanding of the objectives and how they are intended to be used. Teachers should feel free to add/adapt objectives which will fit the material to student and community needs. Supporting material will, of course, need to be added for any new objectives.

Table of contents, references (color-coded white)

These pages have been coded pink for instructor use only. The reference section lists materials used as sources in developing the material.

Information sheets (green)

Presented in outline form for clarity, these pages provide content essential for meeting the cognitive (knowledge) objectives in the unit. Students should study the information sheets before class discussion or completion of assignment sheets.

Transparency masters (white)

Transparencies provide information by visually reinforcing or clarifying ideas presented in the information sheets. They are effective when identification is necessary and when they direct the student's attention to the topic of discussion. Transparencies should be left on the screen only when topics shown are under discussion.

Handouts (white)

Whenever more detailed information than can be presented in a transparency is needed, a handout is used. Handouts give the students additional information that can be kept with their class notes or student references.

Assignment sheets (tan)

Assignment sheets furnish paper-and-pencil practice to develop the knowledge necessary as a prerequisite to skill development. They can be given to students for class completion or used as homework assignments. Answer sheets (color-coded pink) can be used by the student or instructor to check progress.

Job sheets (blue)

These evaluation instruments are provided for two purposes: to outline steps of procedure and to check student performance mastery. Job sheets begin with a list of tools and materials needed for the activity. Job sheets furnish potential employers with a picture of skills being taught and performance which might be reasonably expected from a vocational student. The spaces to the right of the page on a job sheet assist the instructor in evaluating a student on a particular activity. This 3-2-1-N grading system is the same as the one used on the competency profile.

Lesson test (yellow)

Competency-based tests are designed to help eliminate subjective testing and to improve student evaluation and accountability. Specific competencies and test questions are linked on the answer key. These lesson tests have been written to be used with computerized VAMS (Vocational Administrative Management System), utilizing Scantron sheets for computer-recording of test answers.

The lesson test may be eliminated if the competency was thoroughly evaluated by job sheets. However, an emphasis should be placed on cognitive as well as performance skills. If the objective or competency will be evaluated by a job sheet, it is often necessary to determine by a written test whether the student understands enough of the material to perform the job sheet.

SUGGESTED ACTIVITIES

The following list of suggested activities may be helpful.

1. Provide students with objective sheet and information sheets.
2. Discus specific objectives.
3. Discuss information sheets, assignment sheets and/or job sheets, lesson-by-lesson.
4. Have students do assignment sheet(s) to satisfactory levels.
5. Give students lesson test.
6. After successful completion of the test, have students do job sheet(s).

Students should perform the following activities.

1. Read objective sheet.
2. Study information sheets.
3. Do assignment sheet(s).
4. Take lesson test.
5. Do job sheets.

PACKAGING

This Building Maintenance guide has been packaged with an entire class in mind. For the teacher, a complete instructor's guide contains all six modules. In the student reference, selected portions have been reproduced for student use (objectives, information sheets, handouts). Student work sheets (assignment sheets, job sheets, lesson tests) have been packaged together for student distribution as the instructor deems necessary.

In the student reference, page numbers do not run consecutively because some pages have been removed that appear only in the instructor's guide.

Building Maintenance

Module: Grounds Maintenance

Cross-Reference Table of Instructional Materials

Competency	Unit	Instructional Objective	Transparency Master	Handout	Assignment Sheet	Job Sheet	Test Item	Notes
I-1	I	1.1-1.6	1-5				1-68	
I-2	I	2.1-2.13	1-6			1,2	1-57	
I-3	I	3.1-3.8	1-6			1-6	1-63	
I-4	I	4.5				1	1-38	
I-5	I	4.1-4.6	1,2			1,2	1-32	
I-6	I	3.9-3.10	1-6			1-6	1-63	
I-7	I	3.11	1-6			1-6	1-63	
I-8	I	6.1-6.6	1,2			1,2	1-20	
I-9	I	4.9-4.10				1,2	1-38	
I-10	I	4.6-4.8				1-3	1-38	
I-11	I	4.1-4.4					1-38	
	II	1.1-1.3	1,2			1,2	1-11	
I-12	I	4.1-4.4					1-38	
J-1	II	1.4	1,2			1,2	1-11	
J-2	II	2.1-2.20	1-5			1	1-88	
J-3	II	3.1-3.11	1,2			1	1-43	
J-4	II	4.1-4.26	1-3		1,2	1	1-74	
J-5	II	5.1-5.14	1,2			1	1-76	
J-6	II	6.1-6.14	1-4			1	1-63	

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 1: SAFETY

LESSON OBJECTIVE

After completion of this lesson, the student should be able to DISTINGUISH BETWEEN SAFE AND UNSAFE SHOP PRACTICES IN SERVICING GROUND MAINTENANCE EQUIPMENT. Mastery will be evidenced by scoring ________ percent on the lesson test.

SPECIFIC OBJECTIVES

In completing the requirements for this lesson, the student will:

1. Match terms related to safety with their correct definitions.
2. Complete a list of steps for maintaining a safe and orderly shop.
3. Identify the three components of the fire triangle.
4. Distinguish between saf[illegible] unsafe shop practices.
5. Complete a list of statements concerning Consumer Product Safety Commission standards.
6. List four general shop safety rules.

Completion of the requirements of this lesson fulfills competency I-1 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 1: SAFETY

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
   1. The fire triangle
   2. Use care with gasoline
   3. Proper use of equipment
   4. Unplug equipment before working
   5. Proper handling of batteries

D. Lesson test

E. Answers to lesson test

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 1: SAFETY

INFORMATION OUTLINE

I. Terms and definitions

   A. Safety--state or condition of being safe; freedom from danger, risk or injury

   B. Accident--any suddenly occurring, unintentional event that causes injury or property damage

   C. First aid--immediate, temporary care given the victim of an accident or sudden illness until the services of a physician can be obtained

   D. Carbon monoxide--colorless, odorless, very poisonous gas formed by incomplete combustion

   E. Battery--number of complete electrical cells assembled in one housing or case; used in small engines to run and/or start the engines

   F. Service manual---professional book giving exact details, tools, and procedures for servicing one or more types of engines

   G. Carburetor and/or parts cleaner--chemical solution for dissolving deposits such as grease, varnish, gum and paint from parts without damage to the metal

II. Steps for maintaining a safe and orderly shop

   A. Arrange machinery and equipment to permit safe, efficient work practices and easy cleaning

   B. Stack or store materials and supplies safely in proper places

   C. Store tools and accessories safely in cabinets, racks or other suitable devices

   D. Keep working areas and work benches clear and free of debris and other hazards

   E. Keep floors clean and free from obstructions and slippery substances

F. Keep aisles, traffic areas and exits free of material and other debris

G. Properly dispose of combustible materials or store them in approved containers

H. Store oily rags in self-closing or spring-lid metal containers

I. Know the proper procedures to follow to keep the work area clean and orderly

J. Have sufficient brooms, brushes or other housekeeping equipment readily available

III. Components of the fire triangle (TM 1)

A. Fuel--any combustible material

B. Heat--enough to raise the fuel to its ignition temperature

C. Oxygen--necessary to sustain combustion

(Note: To produce fire, these three elements are necessary and must be present at the same time --if any one of them is missing, a fire cannot be started--with the removal of any one of them, the fire will be extinguished)

IV. Rules of safety (TM 1, TM 2, TM 3, TM 4, TM 5)

A. Fire prevention
1. Never strike sparks in a room or area where flammable liquids are used or stored
2. Use only approved safety cans for storage of flammable liquids and label them properly
3. Do not fill a hot or running engine with gasoline

(Note: It may spill and cause a fire)

4. Use a commercial nonflammable cleaner for cleaning tools and parts

(Note: Do not use gasoline as a cleaner for tools or parts)

5. Change any oil- or gasoline-soaked clothes immediately

(Note: A spark, a hot exhaust manifold, or an open flame can easily ignite such clothing)

6. Learn the location and use of fire extinguishers for each class of fire
7. Dispose of oil- or gasoline-soaked rags and other debris in self-closing, air-tight metal containers provided for this purpose
8. Avoid placing live electrical wires near fuel lines, carburetors, gas tanks or fuel-storage containers

B. Oil and grease
1. Wipe up immediately any spilled oil, grease or other liquids

(Note: Use oil-absorbent materials on the oil--this will prevent slipping)

2. Do not direct oil spray toward other workers
3. Always have the proper container on hand to catch fuel, oil or other fluids before attempting to drain them

(Note: When the fluid has been drained, move it to a safe place away from fire hazards)

4. Do not pour old oil on the ground, down a drain, or into a natural watershed

(Note: Consult your instructor regarding local ordinances for disposal of oil and greases)

5. Do not oil an engine while it is running or attempt to oil or wipe moving parts

C. Eye protection--always wear safety goggles while performing the following operations or as required by state and school policy
1. Grinding, chipping or drilling
2. Working around equipment being operated
3. Operating power equipment
4. Charging batteries or using caustic cleaning compounds

(Note: Wear splash-proof goggles when using acids or caustic liquids such as carburetor and parts cleaners)

D. Electrical
   1. ANY and ALL dangerous conditions of equipment should be reported to the instructor
   2. Use third-wire cords and plugs to ground all portable lights and tools

      (Note: This is not necessary on tools that are double insulated)

   3. Check the condition of cords, plugs and sockets
   4. Eliminate cords and wires as trip hazards
   5. Coil and hang or store power tools and cords properly

E. Air pressure
   1. Never use compressed air equipment for dusting off clothing or work benches

      (Note: Flying particles may be blown into your eyes or skin or into that of others)

   2. Never use compressed oxygen in place of compressed air
   3. Use compressed air only for the purpose it was intended and in a manner approved by OSHA

F. Equipment
   1. Do not operate any machine without having been instructed in its use
   2. Never start an engine before determining that everyone is in the clear
   3. Never start an engine without knowing how to shut it off and being ready to do so if the need arises
   4. Keep hands and clothing away from moving parts

      (Note: A few of the moving parts that concern us are: flywheels, blades, fans, gears, pulleys, belts, chains, generators, and power take off (PTO) shafts)

   5. Never run an engine in an inadequately ventilated place

      (Note: Remember that carbon monoxide fumes from an engine can kill)

   6. Read and heed all notes and cautions

      (Note: Throughout this material and in almost every service manual you will come across many passages with these headings)

7. Read instructions thoroughly and follow them carefully

   (Note: Do not attempt shortcuts)

8. If you lack the proper tools or have doubts about your ability to do the job correctly, consult your instructor
9. Be sure your work area is adequately lighted

   (Note: Have a portable safety light for working under equipment)

10. Wear reasonably tight-fitting, appropriate clothing while working in the shop
11. Never wear a necktie, necklace or other loose apparel to work in the shop

    (Note: Button sleeves and secure or cover long hair behind your head or up to prevent snagging in power equipment)

12. Always disconnect and ground the wire from the spark plug before inspecting or repairing any mower, tiller, saw or other power equipment

    (Note: The engine may accidentally start and cause serious injury)

13. After reassembly, be sure all parts, nuts, bolts and screws are securely in place

    (Note: Loose or missing parts can interfere with the operation of the equipment, and damage or injury may result)

14. Use ear protection as needed

G. Batteries
   1. Handle batteries with care and use a battery strap or carrier
   2. Always hold battery upright and set securely so there is no danger of spilling acid
   3. Never smoke, use an open flame or cause a spark on battery terminals, especially on a charging battery or charging area

      (Note: Hydrogen gas is given off in charging, and it may explode and splatter acid)

4. Wear protective clothing such as chemical goggles, rubber aprons, gloves and boots while working in battery-charging operations
5. When mixing battery solutions, always pour acid into water

   (Note: Reversing this mixing procedure to water into acid increases the possibility of splashing the acid on you)

6. If acid splashes on you, flush immediately with plenty of cold water and notify instructor

   (Note: This is especially important if acid gets into your eyes)

7. Do not short circuit the battery to test it

   (Note: A fire or explosion may result)

8. Prevent accidental short circuits by disconnecting and insulating grounded battery cable before working on equipment
9. Use appropriate charging amperage when charging battery, and remove all battery caps
10. Never charge a frozen battery

V. Consumer Product Safety Commission (CPSC) standards

(Note: June 30, 1982, marked the last day a walk-behind power lawnmower could be built or imported for U.S. consumers without complying with the CPSC "Safety Standard for Walk-Behind Power Lawn Mowers")

A. The standard defines a "walk-behind lawnmower" as a grass-cutting machine with a minimum cutting width of 12 inches

B. The standard specifies performance requirements for most rotary lawnmowers manufactured or imported after June 30, 1982--in addition to the warning label, requirements include:

   (Note: Prior to June 30, 1982, the first phase of the standard only required a warning label stating: "Danger," "Keep hands and feet away")

   1. Every affected rotary lawnmower must carry a certification label

2. The path of the blade on a rotary lawnmower must be shielded in such a manner that the unit can successfully pass specified tests, including a "foot probe" test and an "obstruction" test
3. A blade control system is required that:
    a. Prevents the blade from operating unless the operator actuates the control
    b. Requires continuous contact with the control to keep the blade in motion
    c. Stops the blade completely within three seconds after release of the control

    (Note: For electrically-powered lawnmowers or electric-start lawnmowers, the starting controls must be located within approximately 15" of the rearmost part of the lawnmower handle)

4. All units must be equipped with a second control, either a separate safety lever or a device incorporated into the blade control, so that two distinct actions are required to restart the blade

C. The standard expressly applies to the manufacturer and initial sale to consumers--it is silent with respect to service and repair of so-called "compliance" units

(Note: Any modification made by a dealer at the time of the sale to a consumer that renders the mower noncomplying would be a violation of the standard--however, if later the owner brings the lawnmower in for servicing and asks a dealer or repair person to disable a safety feature required by the standard, such an action would not be in violation of the standard because it does not involve a sale--dealers are encouraged, however, not to eliminate any safety feature since such action may create potential liability in the event someone is subsequently injured because a safety feature was missing)

VI. General shop safety rules

A. All injuries should be treated at once

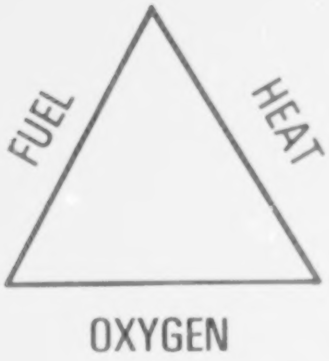
B. Safety equipment and shoes should be used and worn as required

C. Running and horseplay are not permitted in the shop at any time

D. Report ANY and ALL dangerous conditions or damaged equipment

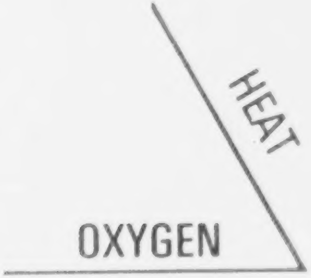
The Fire Triangle

To produce fire, three things must be present at the same time.


FUEL
HEAT
OXYGEN

GM 13

If any one of the three is missing, a fire cannot be started or, with the removal of any one, the fire will be extinguished.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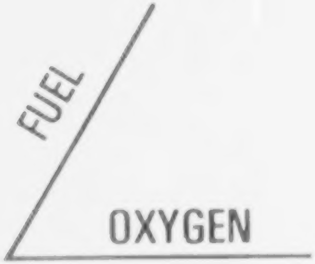
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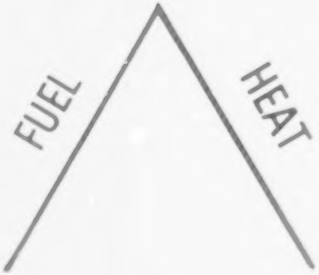
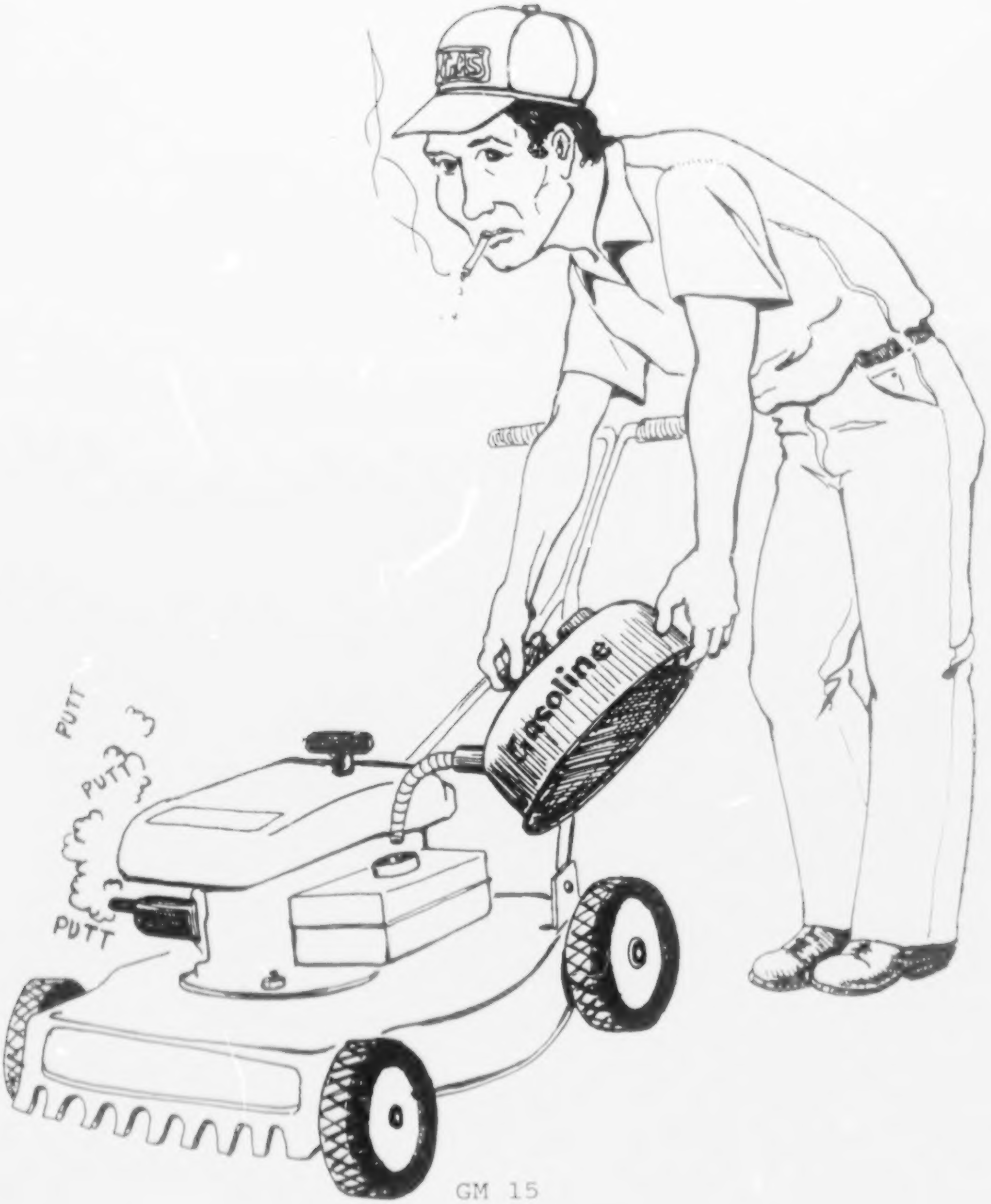


TM 1

Use Care With Gasoline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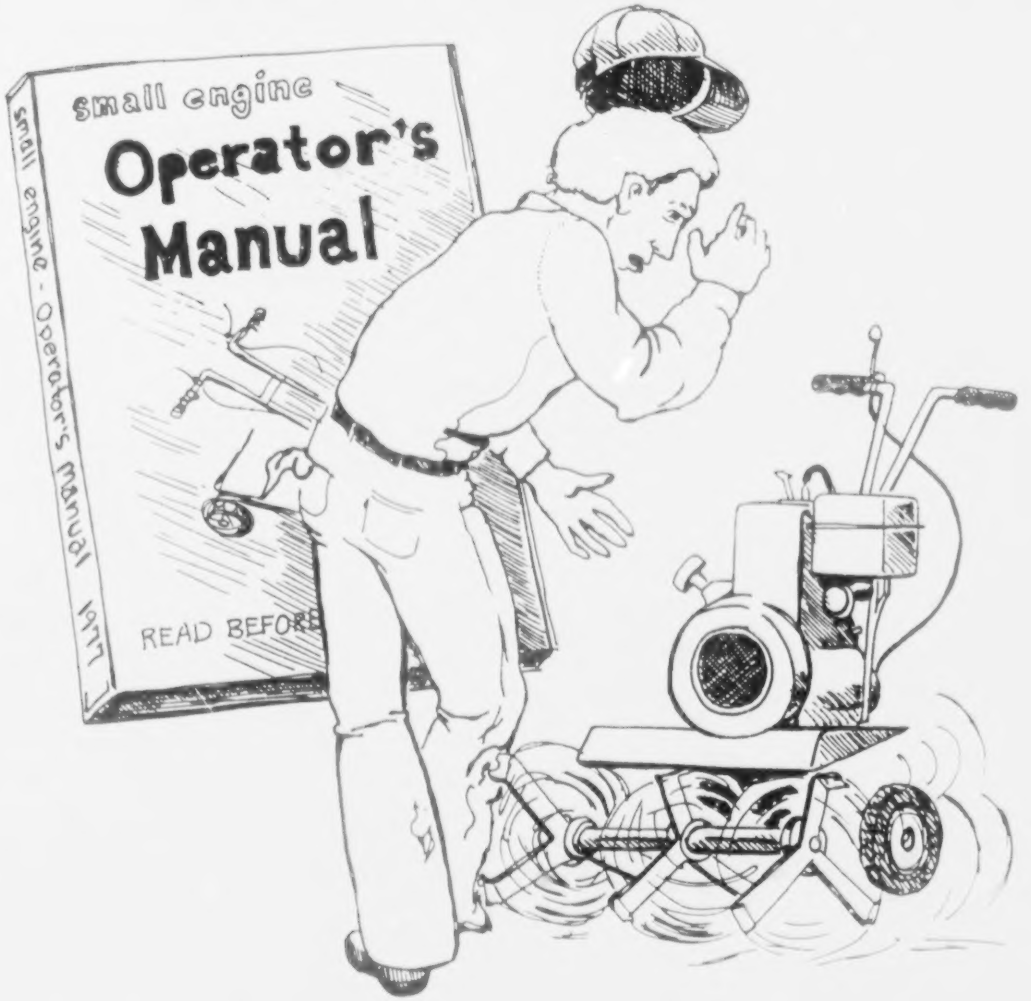
Gasoline

GM 15

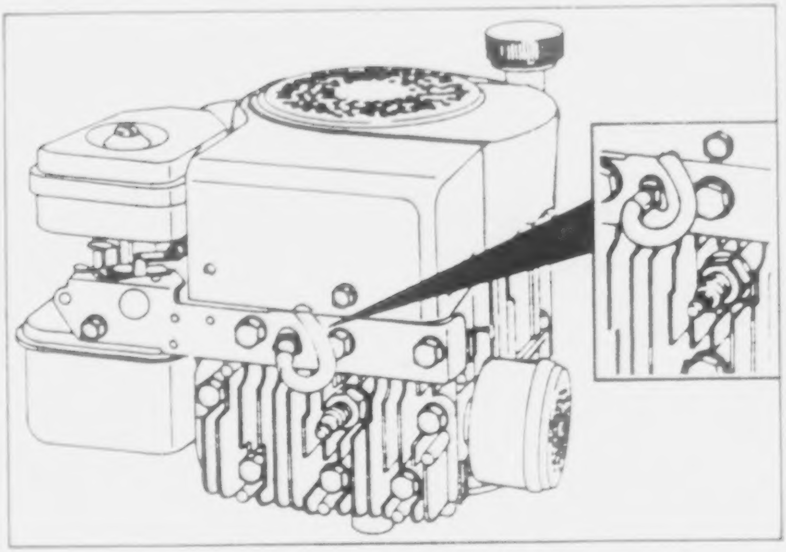
Proper Use of Equipment


small engine
Operator's
Manual
small engine - Operator's Manual 1977
READ BEFORE

Read Your Operator's Manual Before Operating Equipment

Do Not Wear Loose Fitting Clothing Around Equipment, and Stay Clear of the Moving Parts While the Engine Is Running

Unplug Equipment Before Working

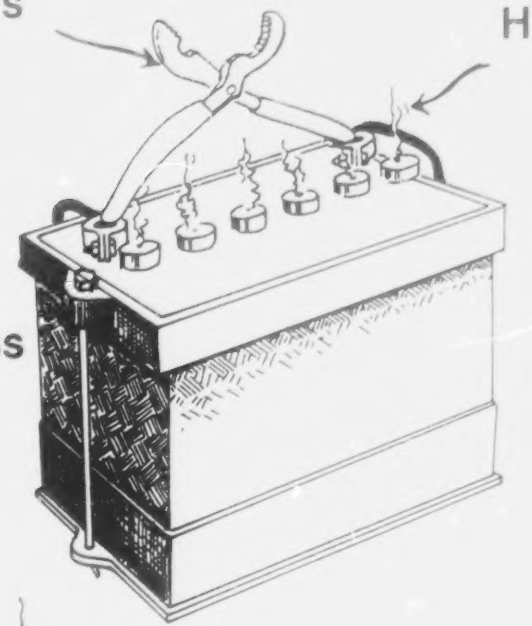


Disconnect the Spark Plug Lead
to Keep the Engine From
Accidentally Starting

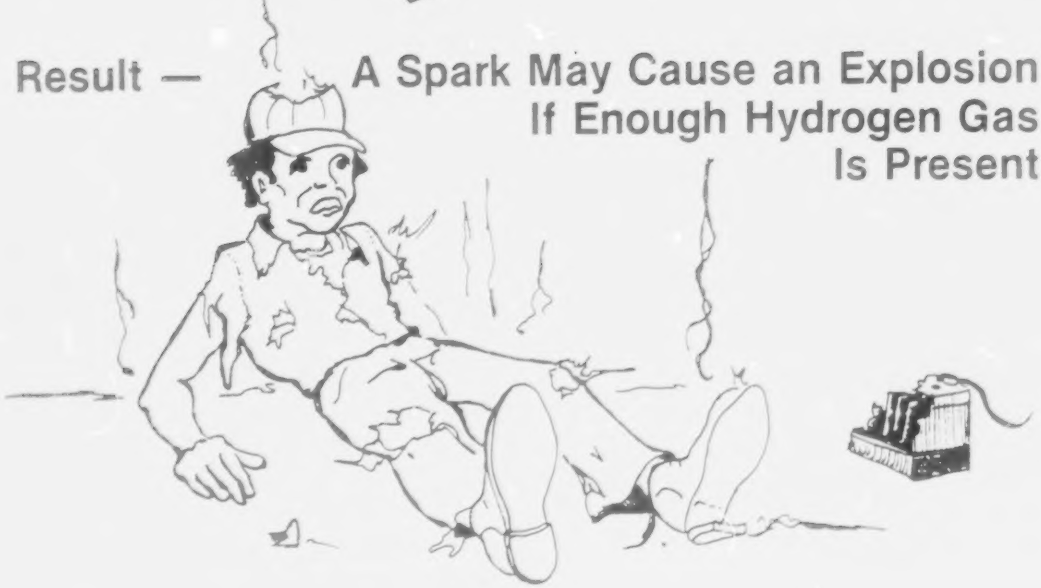
TM 5

Proper Handling of Batteries

Do Not Arc Terminals to Test — Or to Cause a Spark


Pliers
Hydrogen Gas
Carelessness

Result — A Spark May Cause an Explosion If Enough Hydrogen Gas Is Present



MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 1: SAFETY

LESSON TEST

Part 1. Match the terms below with their correct definitions.

A. Battery
B. Accident
C. First aid
D. Carbon monoxide
E. Service manual
AB. Carburetor or parts cleaner
AC. Safety

_____ 1. State or condition of being safe; freedom from danger, risk or injury

_____ 2. Any suddenly occurring, unintentional event that causes injury or property damage

_____ 3. Immediate, temporary care given the victim of an accident or sudden illness until the services of a physician can be obtained

_____ 4. Colorless, odorless, very poisonous gas formed by incomplete combustion

_____ 5. Number of complete electrical cells assembled in one housing or case; used in small engines to run and/or start the engines

_____ 6. Professional book giving exact details, tools, and procedures for servicing one or more types of engines

_____ 7. Chemical solution for dissolving deposits such as grease, varnish, gum and paint from parts without damage to the metal

Part 2. Using the list of words below, complete the following steps for maintaining a safe and orderly shop.

A. housekeeping
B. combustible
C. hazards
D. easy cleaning
E. slippery
AB. cabinets
AC. metal
AD. exits
AE. stack
BC. orderly

_____ 8. Arrange machinery and equipment to permit safe, efficient work practices and_______________________

_____ 9. _________________ or store materials and supplies safely in proper places

_____10. Store tools and accessories safely in______________, racks or other suitable devices

_____11. Keep working areas and work benches clear and free of debris and other _______________

_____12. Keep floors clean and free from obstructions and _________________ substances

_____13. Keep aisles, traffic areas and____________ free of material and other debris

_____14. Properly dispose of_______________ materials or store them in approved containers

_____15. Store oily rags in self-closing or spring-lid________ containers

_____16. Know the proper procedures to follow to keep the work area clean and_________________

_____17. Have sufficient brooms, brushes or other housekeeping _________________ readily available

Part 3. Place a "T" on the blank beside correct statements of safe shop practices. Place an "F" beside incorrect shop safety statements.

A. Fire prevention

_____18. Never strike sparks in a room or area where flammable liquids are used or stored

_____19. Use only approved safety cans for storage of flammable liquids and label them properly

_____20. Gasoline may be poured into an engine at any time

_____21. Wash engine parts in a pan of gasoline

_____22. Change any oil- or gasoline-soaked clothes immediately

_____23. Learn the location and use of fire extinguishers for each class of fire

_____24. Dispose of oil- or gasoline-soaked rags by throwing them in a corner or under a table out of the way

______25. Avoid placing live electrical wires near fuel lines, carburetors, gas tanks or fuel-storage containers

B. Oil and grease

______26. When a job is messy and more oil will be spilled on the floor, wait until the job is completed to use oil-absorbent materials to clean the floor

______27. Do not direct oil spray toward other workers

______28. Always have the proper container at hand to catch fuel, oil or other fluids before attempting to drain them

______29. Pour old oil down a drain

______30. The best time to do a good oil job is when the machine or engine is running

C. Eye protection--always wear safety goggles while performing the following operations or as required by state and school policy.

______31. Grinding, chipping or drilling

______32. Working around equipment being operated

______33. Operating power equipment

______34. Charging batteries or using caustic cleaning compounds

D. Electrical

______35. ANY and ALL dangerous conditions of equipment should be reported to the instructor

______36. Treat all electrical equipment as "live" until you have carefully checked

______37. Use two-wire cords and plugs to ground all portable lights and tools

______38. Check the condition of cords, plugs and sockets

______39. Eliminate cords and wires as trip hazards

______40. Leave out tools and pieces of equipment where you finish work today so you can quickly resume work tomorrow

______41. Be prepared to turn off any electrical power switch and/or main switch in case of emergency

E. Air pressure

______42. Never use compressed air equipment for dusting off clothing or work benches

______43. Never use compressed oxygen in place of compressed air

______44. Use compressed air only for the purpose it was intended and in a manner approved by OSHA

F. Equipment

______45. Do not operate any machine without having been instructed in its use

______46. Start an engine when you are ready and hope that everyone is in the clear

______47. Never start an engine without knowing how to shut it off and being ready to do so if the need arises

______48. Keep hands and clothing away from moving parts

______49. Never run an engine in an inadequately ventilated place

______50. Read and heed all notes and cautions

______51. Read instructions thoroughly and follow them carefully

______52. If you lack the proper tools or have doubts about your ability to do the job correctly, consult your instructor

______53. Be sure your work area is adequately lighted

______54. Wear reasonably tight-fitting shorts or cutoffs while working in the shop

______55. Wear a necktie and loose-fitting apparel in the shop

______56. Always disconnect and ground the wire from the spark plug before inspecting or repairing any mower, tiller, saw or other power equipment

______57. After reassembly, be sure all parts, nuts, bolts and screws are securely in place

G. Batteries

______58. Handle batteries with care and use a battery strap or carrier

______59. Always hold battery upright and set securely so there is no danger of spilling acid

______60. Disconnect the battery charger from the terminals before shutting off the machine, even though it may spark

______61. Wear protective clothing such as chemical goggles, rubber aprons, gloves and boots while working in battery-charging operations

______62. If acid splashes on you, flush immediately with plenty of water and notify instructor

______63. When mixing battery solutions, always pour acid into water

______64. When mixing battery solutions, always pour water into acid

______65. Test a battery with a pair of pliers, between the terminals, if it is believed to be dead

______66. Prevent accidental short circuits by disconnecting and insulating grounded battery cable before working on equipment

______67. Use appropriate charging amperage when charging battery, and remove all battery caps

______68. Charge a frozen battery

Part 4. Using the words below, complete the following list of statements concerning Consumer Product Safety Commission standards by putting the letter of the correct choice on the blank.

A.	June 30, 1982	D.	certification
B.	12 inches	E.	manufacturer
C.	three seconds		

_____69. The standard defines a "walk-behind lawnmower" as a grass-cutting machine with a minimum cutting width of ____________.

_____70. The standard specifies performance requirements for most rotary lawnmowers manufactured or imported after ________.

_____71. Every affected rotary lawnmower must carry a __________________ label.

_____72. A blade control system is required that stops the blade completely within _________________ after release of the control.

_____73. The standard expressly applies to the ________________ and initial sale to consumers. It is silent with respect to service and repair of so-called "compliance" units.

Part 5. Identify the three components of the fire triangle.

Part 6. List four general shop safety rules.

____

____

____

____

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

ANSWERS TO UNIT I, LESSON 1 TEST

Part 1.

1. AC
2. B
3. C
4. AB
5. E
6. A
7. D

Part 2.

8. D
9. AE
10. AB
11. C
12. E
13. AD
14. B
15. AC
16. BC
17. A

Part 3.

18. T
19. T
20. F
21. F
22. T
23. T
24. F
25. T
26. F
27. T
28. T
29. F
30. F
31. T
32. T
33. T
34. T
35. T
36. T
37. F
38. T
39. T
40. F
41. T
42. T
43. T
44. T
45. T
46. F
47. T
48. T
49. T
50. T
51. T
52. T
53. T
54. F
55. F
56. T
57. T
58. T
59. T
60. F
61. T
62. T
63. T
64. F
65. F
66. T
67. T
68. F

Part 4.

69. B
70. A
71. D
72. C
73. E

Part 5.

Fuel, Heat, Oxygen

Part 6.

A. All injuries should be treated at once.
B. Safety equipment and shoes should be used and worn as required.
C. Running and horseplay are not permitted in the shop at any time.
D. Any and all dangerous conditions or damaged equipment should be reported to the instructor.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 2: CHANGING OIL/FILTER AND SERVICING BREATHER

LESSON OBJECTIVE

After completion of this lesson, the student will be able to CHANGE ENGINE OIL AND FILTER AND SERVICE THE CRANKCASE BREATHER. Mastery will be evidenced by completion of job sheets and by scoring __________ percent on the lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match terms related to lubrication systems with their correct definitions.
2. Distinguish between the two types of lubrication systems.
3. Select purposes of the crankcase breather.
4. Match components of the crankcase breather with their correct purposes.
5. Complete a list of functions of engine oil.
6. Select characteristics of a good engine oil.
7. List oil contaminants.
8. Match oil additives with their correct functions.
9. Select factual statements about oil.
10. Complete a list of statements concerning the selection and use of oils for best engine performance.
11. Select true statements concerning two-cycle oil selection and use.
12. Demonstrate the ability to change engine oil and filter.
13. Demonstrate the ability to service crankcase breather.

Completion of the requirements of this lesson fulfills competency I-2 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 2: CHANGING OIL/FILTER AND SERVICING BREATHER

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
  1. Dipper lubrication system
  2. Slinger lubrication system
  3. Crankcase breather
  4. Crankcase breather vented to carburetor
  5. Crankcase breather principles
  6. Typical crankcase breather

D. Job sheets
  1. Change engine oil and filter
  2. Service crankcase breather

E. Lesson test

F. Answers to lesson test

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 2: CHANGING OIL/FILTER AND SERVICING BREATHER

INFORMATION OUTLINE

I. Terms and definitions

   A. Multi-grade oils--oils compounded to behave as light oils at cold temperatures and heavy oils at warm temperatures

   B. SAE--Society of Automotive Engineers

   C. API--American Petroleum Institute

   D. Friction--resistance to movement between two objects placed in contact with one another

   E. Sludge--heavy, thick residue found in the bottom of an oil pan caused by oil deterioration or oil contamination

   F. Blow-by--gases under pressure leaking by the piston rings during combustion and the power stroke

   G. Dipper--device fastened to connecting rod as a means of splashing oil

   H. Slinger--device rotated by the camshafts for splashing oil

   I. Oil filter--device used to remove abrasive particles from the oil

   J. Viscosity--a measure of the fluidity of an oil at given temperature

II. Types of lubrication systems (TM 1, TM 2)

   (Note: Some engines use both systems)

   A. Splash system
      1. Dipper type
      2. Slinger types

   B. Pump system
      1. Barrel and plunger type
      2. Gear and rotor type

III. Purposes of crankcase breather (TM 3, TM 4, TM 5)

A. Allows blow-by to escape

B. Limits corrosion of engine parts

C. Prevents oil leaks at seals and gaskets by relieving crankcase pressure

D. Allows entrance of fresh air

IV. Components of the crankcase breather and their purposes (TM 6)

A. Cover (valve)--prevents entrance of excessive amounts of dirt

B. Filter--prevents dirt and abrasives from entering air

C. Baffle--keeps excessive oil from splashing onto filter

D. Reed--limits amount of fresh air entering crankcase and allows blow-by to leave engine

V. Functions of engine oil

A. Reduces friction and wear

B. Cools moving parts

C. Helps seal cylinders

D. Keeps parts clean

E. Cushions moving parts

VI. Characteristics of good engine oil

A. Keeps protective film on moving parts

B. Resists breakdown at high temperatures

C. Resists corrosion and rusting

D. Prevents carbon build-up

E. Flows easily at low temperatures

F. Resists foaming

G. Resists breakdown after long use

VII. Oil contaminants

A. Foreign particles

B. Water

C. Antifreeze

D. Fuel

E. Oxidation

F. Acids

VIII. Oil additives and their functions

(Note: Most oils already have these additives)

A. Anti-corrosion--helps prevent failure of alloy bearings from corrosive acids caused by combustion

B. Oxidation inhibitor--prevents acid, varnish and sludge formations

(Note: Oxidation causes oil to thicken)

C. Anti-rust--prevents rusting of metal parts during storage or downtime

D. Viscosity index improver--helps oil give top lubricating protection at both high and low temperatures

E. Pour point depressant--prevents wax crystals from congealing in cold weather and forming clumps

F. Extreme pressure--assures lubrication where extreme pressures between close tolerances are encountered

G. Detergent-dispersant--helps keep metal surfaces clean and prevents deposit formation

H. Foam inhibitor--helps prevent air bubbles that would restrict lubrication

(Note: Fast circulation causes oil to foam)

IX. Factual statements about oil

A. Oil becomes unfit for further use as it absorbs contaminants and as additives are depleted

B. Multi-viscosity oils are not always preferred

C. Black oil does not mean time for an oil change

D. Buy quality oil filters as recommended by machine operator's manual

E. Oil oxidation results in thicker oil

F. Using a light oil until consumption increases and then switching to a heavier oil is not a good practice

G. Following recommendations in the operator's manual are critical to good performance

X. Selection and use of oils for best engine performance

A. Use brands that meet engine manufacturer's specifications

B. Drain and change at recommended intervals

C. Select oils that have been performance tested

D. Never mix oils of various specifications

E. Bring engine up to normal operating temperature each time it is used

F. Use clean oil containers and keep covered, sealed, and protected to prevent contamination

G. Replace or clean filters before they become plugged

XI. Two-cycle oil selection and use

A. Selection
   1. Select only manufacturer's recommended rating

      (Note: Pumps on oil injection systems are designed for the weight oil recommended by the manufacturer--using wrong rating can affect lubrication)

   2. Select only oil recommended for use in either air cooled or water cooled two-cycle engines

      (Note: The use of standard detergent oils can cause carbon build up in cylinder head and around moving parts)

B. Use

(Note: There are no SAE standards for two-cycle oils --currently four-cycle standards are being used)

1. Use oil-fuel mixture recommended by manufacturer

   (Note: Just because an oil is rated for a 50-1 mixture doesn't mean your engine is)

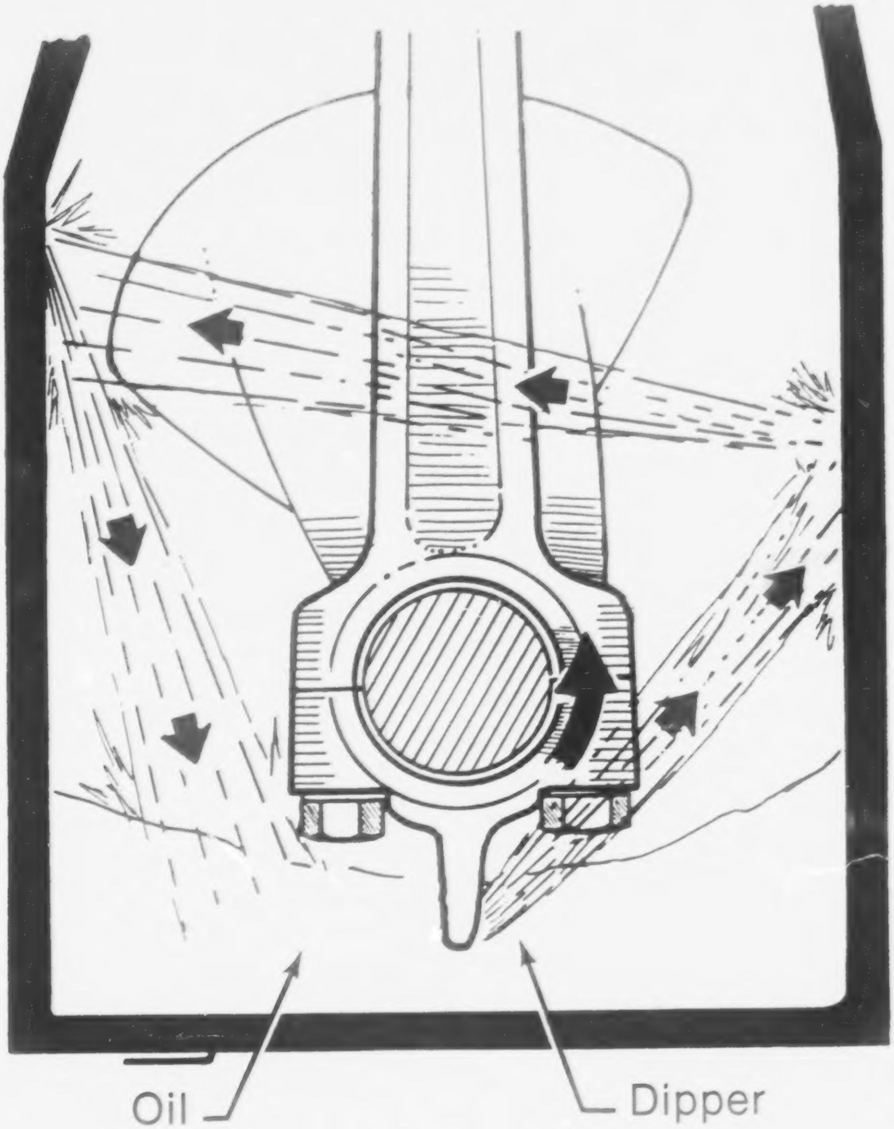
2. Use oils that meet or exceed manufacturer's recommendations

   (Note: A good quality oil may seem expensive when compared to a more economical brand, but it is inexpensive when compared to an overhaul)

3. Never mix synthetic oils with mineral oils

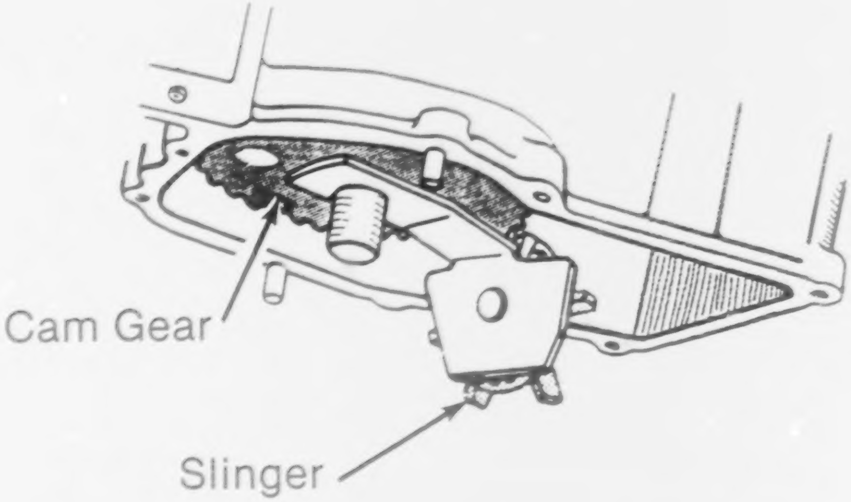
TM 1

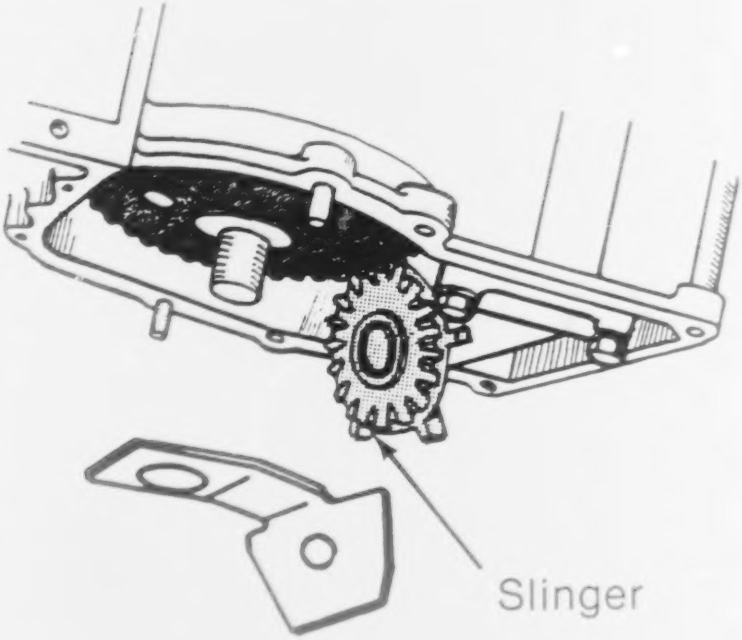
Dipper Lubrication System



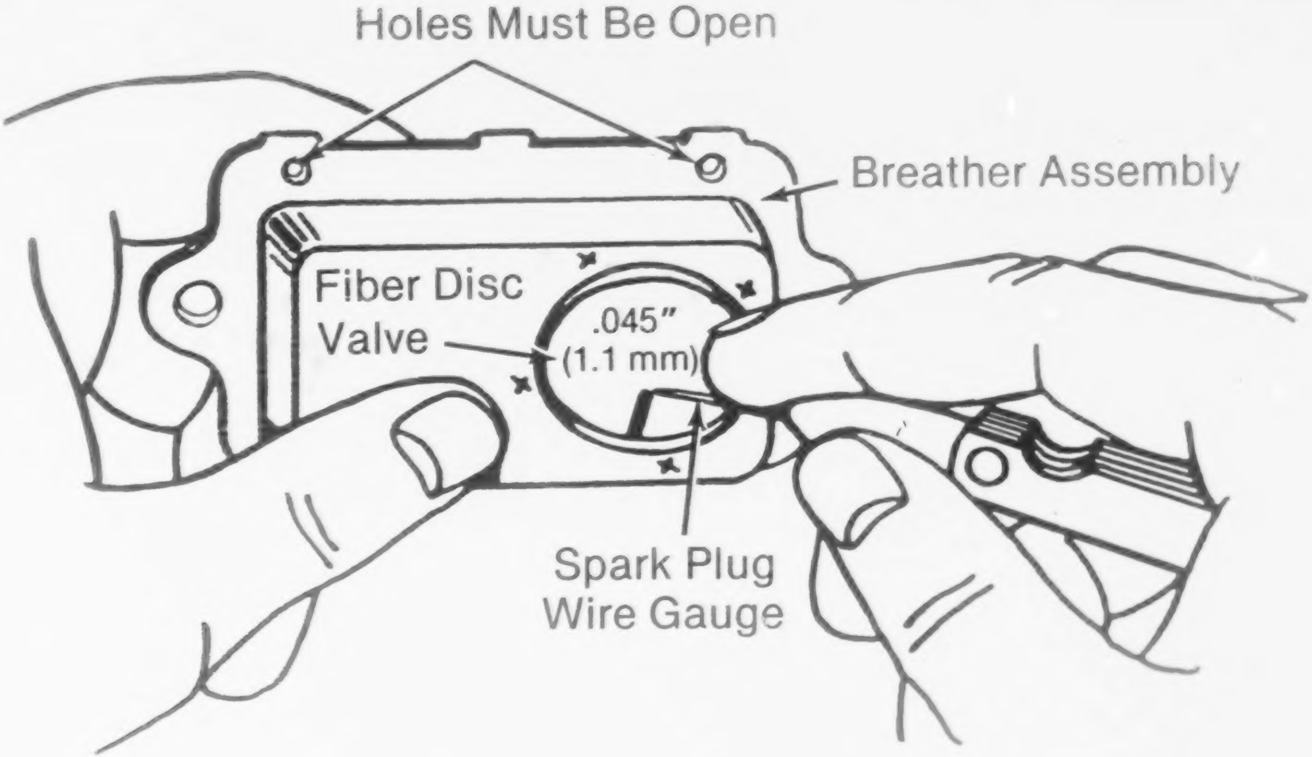
TM 2

Slinger Lubrication System

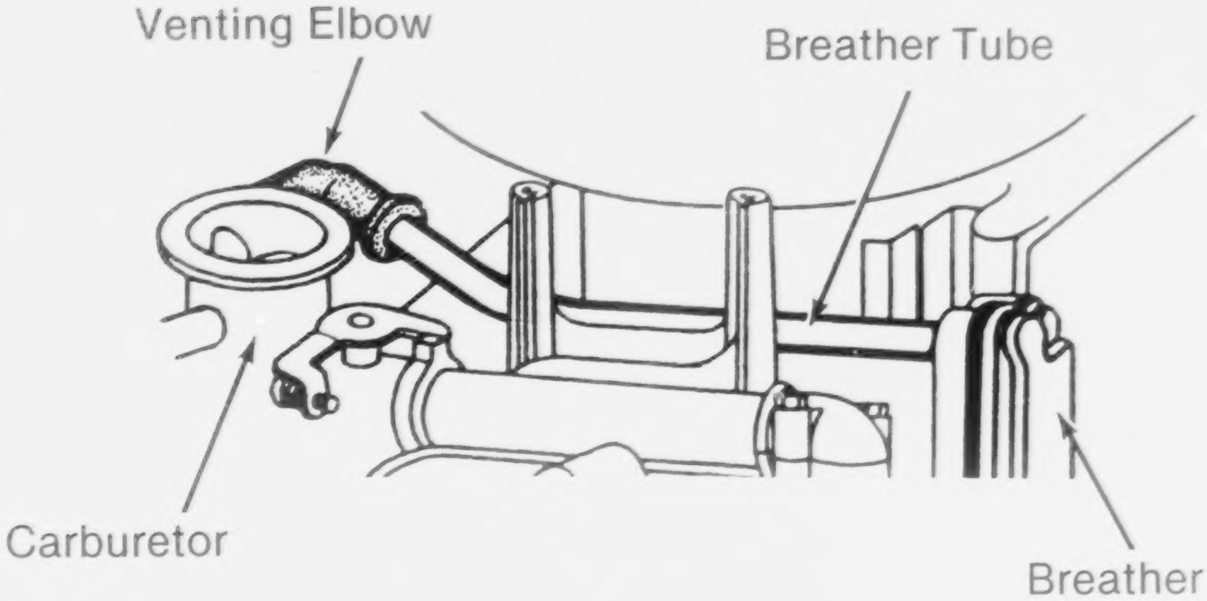

Cam Gear
Slinger



Crankcase Breather


Holes Must Be Open
Breather Assembly
Fiber Disc Valve
.045″ (1.1 mm)
Spark Plug Wire Gauge

Crankcase Breather Vented To Carburetor

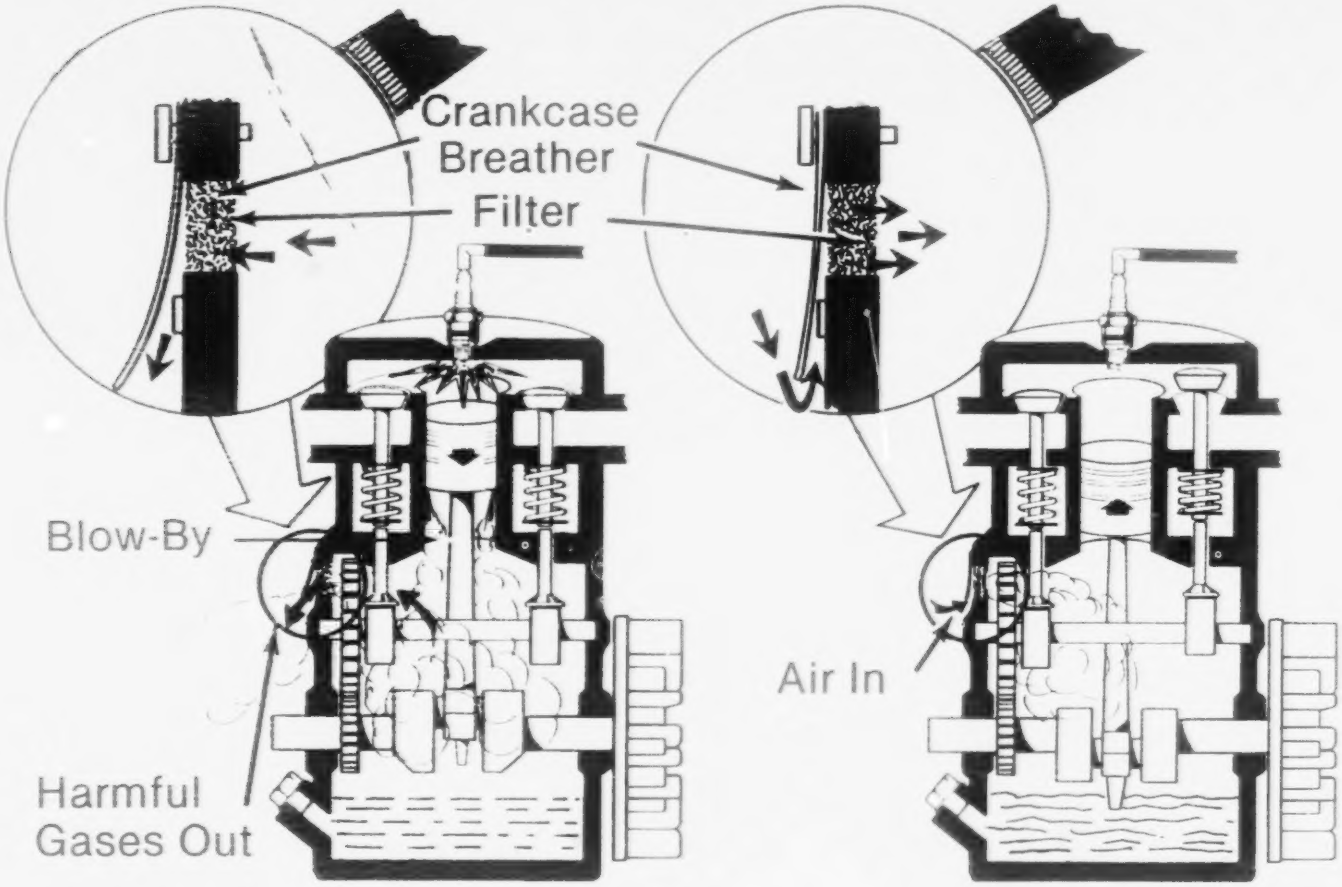

Venting Elbow
Breather Tube
Carburetor
Breather

GM 47

47

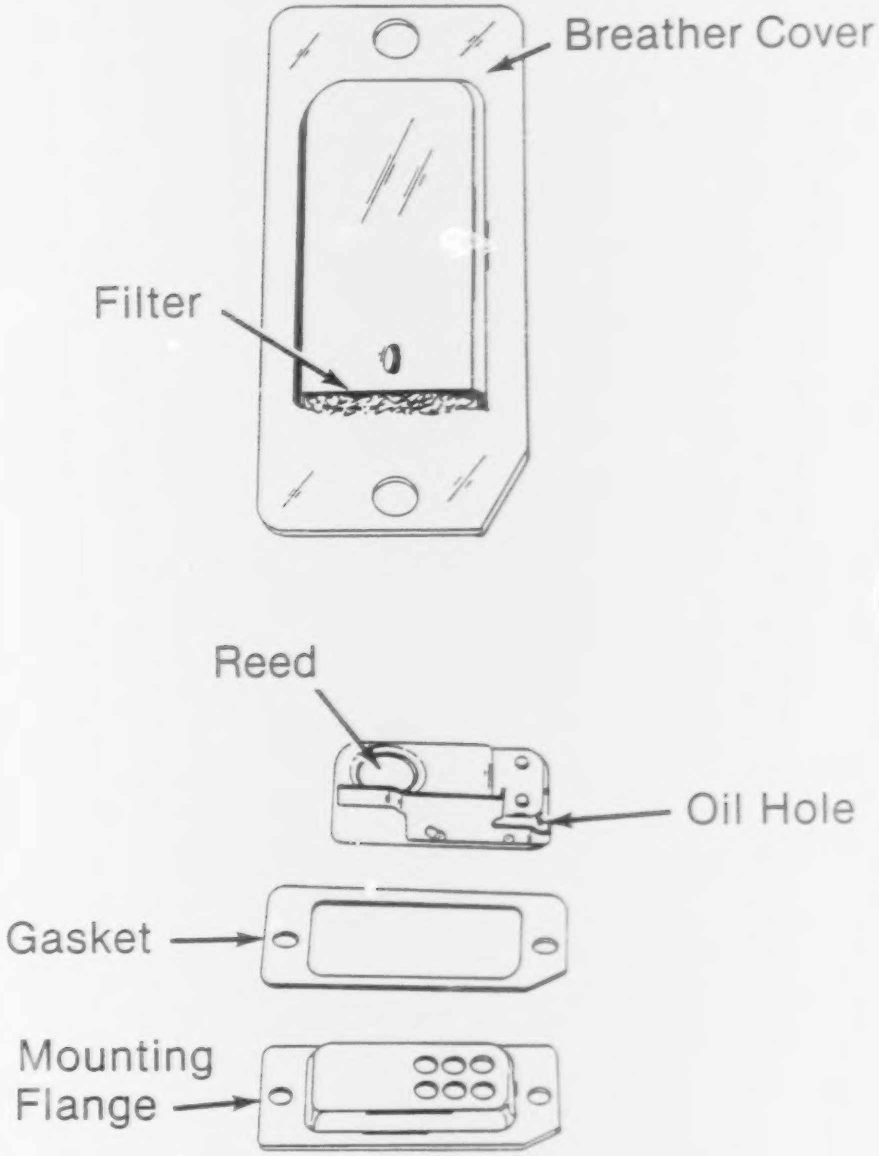
Crankcase Breather Principles

(4 Cycle Engine)


Crankcase
Breather
Filter
Blow-By
Harmful
Gases Out
Air In

TM 6

A Typical Crankcase Breather


Breather Cover
Filter
Reed
Oil Hole
Gasket
Mounting
Flange

CHANGE ENGINE OIL AND FILTER

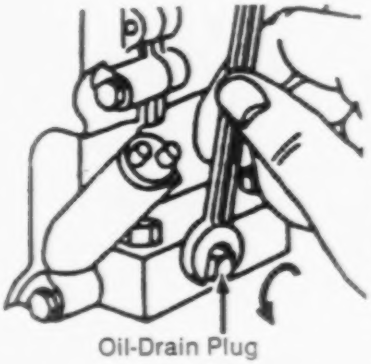
Equipment:

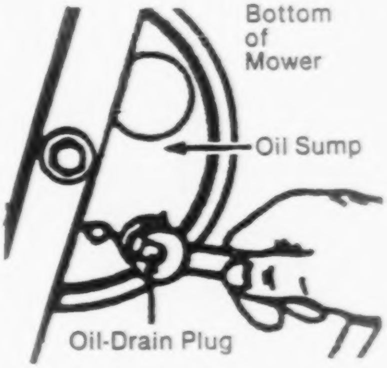
Drain pan
Wrench to fit drain plug
Oil can spout
Shop towels
Safety glasses

Procedure: Evaluation
3 2 1 N

1. Start engine and run to operating temperature. ___ ___ ___ ___
2. Disconnect spark plug wire and ground. ___ ___ ___ ___
3. Place drain pan under drain plug. ___ ___ ___ ___
4. Remove drain plug. ___ ___ ___ ___

(Note: Oil should be drained when hot.)





5. Observe color and condition of oil. ___ ___ ___ ___

(Note: Water and other contaminants might indicate problems in other areas.)

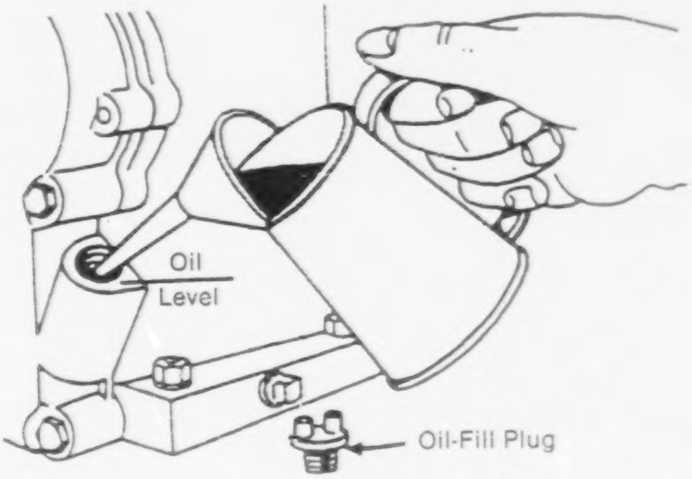
6. Allow oil plenty of time to drain completely. ___ ___ ___ ___
7. Change oil filter if required. ___ ___ ___ ___

8. Replace drain plug. ___ ___ ___ ___

(Note: Start with fingers and tighten adequately with wrench.)

9. Refill crankcase to recommended level with the proper engine oil. ___ ___ ___ ___

(Note: Be sure filler can and spout are clean.)



10. Clean and replace oil filler cap. ___ ___ ___ ___

11. Start engine and operate for a few minutes. ___ ___ ___ ___

12. Check for oil leaks. ___ ___ ___ ___

13. Shut off engine. ___ ___ ___ ___

14. Check oil level. ___ ___ ___ ___

(Note: Add oil if needed. Do not overfill.)

15. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ___ ___ ___ ___

Average of above evaluations* ___ ___ ___ ___

***This average is the student's** partial evaluation for competency **I-2 of Building Maintenance.**

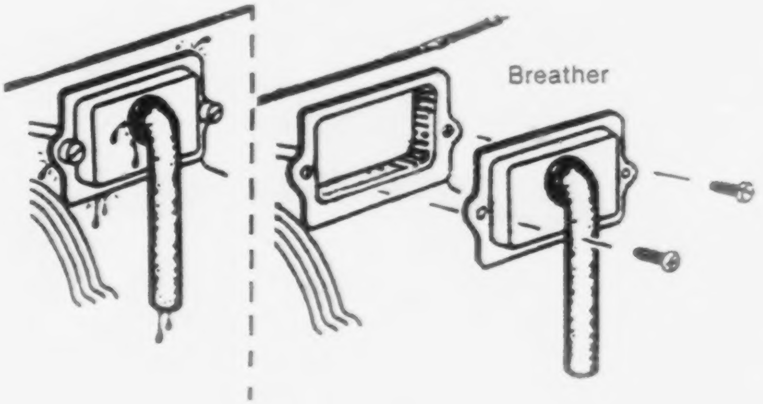
SERVICE CRANKCASE BREATHER

Equipment:

Hand tool assortment
Clean towels
Solvent
Container for cleaning parts
New gasket
Feeler gauge
Safety glasses

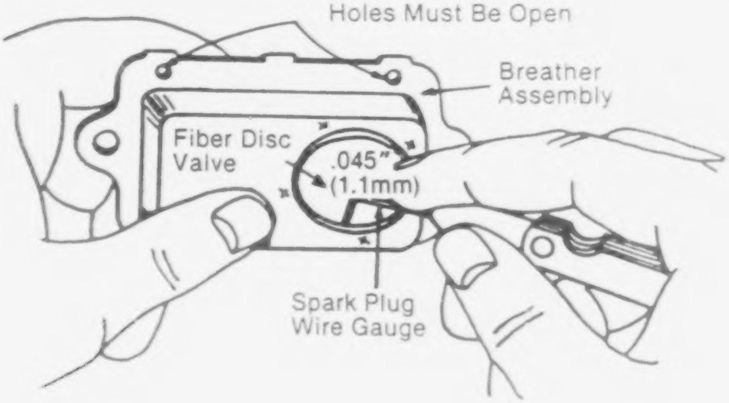
Procedure:

	Evaluation			
	3	2	1	N
1. Disconnect spark plug wire and ground.	___	___	___	___
2. Check breather for proper operation.	___	___	___	___
3. Remove crankcase breather.	___	___	___	___

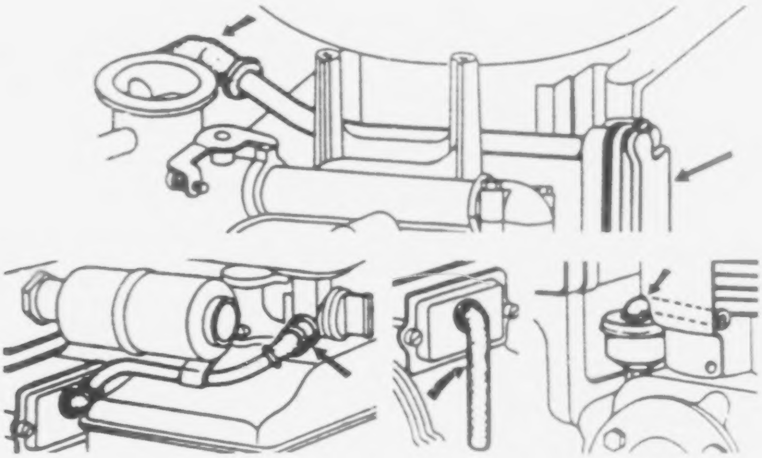


4. Check breather for proper clearance. If a .045 **wire gauge** will enter the space between fiber **disc valve** and body, a new breather should be installed. — — — —

(Note: Do not apply force when checking with wire gauge.)


Holes Must Be Open
Breather Assembly
Fiber Disc Valve
.045"
(1.1mm)
Spark Plug Wire Gauge

5. Inspect venting elbows for loose fit and damaged tubes; replace if necessary. — — — —



6. Clean parts in solvent. ____ ____ ____ ____

7. Dry breather with compressed air. ____ ____ ____ ____

8. Install breather using a new gasket. ____ ____ ____ ____

9. Run engine for a few minutes. ____ ____ ____ ____

10. Check breather for oil leaks. ____ ____ ____ ____

11. Stop engine. ____ ____ ____ ____

12. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ____ ____ ____ ____

Average of above evaluations* ____ ____ ____ ____

*This average is the student's partial evaluation for competency I-2 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 2: CHANGING OIL/FILTER AND SERVICING BREATHER

LESSON TEST

Part 1. Match the terms below with their correct definitions.

A. Viscosity
B. Multi-grade oil
C. Oil filter
D. Slinger
E. Dipper
AB. "W" oils
AC. Friction
AD. Blow-by

______ 1. Oils compounded to behave as light oils at cold temperatures and heavy oils at warm temperatures

______ 2. A measure of the fluidity of an oil at a given temperature

______ 3. Device rotated by the camshafts for splashing oil

______ 4. Device used to remove abrasive particles from the oil

______ 5. Device fastened to connecting rod as a means of splashing oil

______ 6. Gases under pressure leaking by the piston rings during combustion and the power stroke

______ 7. Types of oils that are suitable for winter service

______ 8. Resistance to movement between two objects placed in contact with one another

9. Distinguish between two types of lubrication systems by placing an "X" next to the types of splash systems.

______ A. Barrel and plunger type: gear and rotor type

______ B. Dipper type; slinger type

10. Select purposes of the crankcase breather by placing an "X" in the appropriate blanks.

______ A. Cools engine parts

______ B. Allows blow-by to escape

______ C. Limits corrosion of engine parts

_____ D. Prevents oil leaks at seals and gaskets by relieving crankcase pressure

_____ E. Prevents entrance of fresh air

Part 2. Match components of the crankcase breather on the right with their correct purposes.

A.	Cover (valve)	C.	Baffle
B.	Filter	D.	Reed

_____11. Keeps excessive oil from splashing onto filter

_____12. Prevents entrance of excessive amounts of dirt

_____13. Limits amount of fresh air entering crankcase and allows blow-by to leave engine

_____14. Prevents dirt and abrasives from entering air

Part 3. Complete the following list of functions of engine oil by writing the letter of the correct word in the blanks.

A.	Clean	D.	Cools
B.	Cylinders	E.	Lubricates
C.	Friction		

_____15. Reduces________________and tear

_____16. __________________moving parts

_____17. Helps seal_________________

_____18. Keeps parts_______________

Part 4. Select characteristics of a good engine oil by placing an "X" in the appropriate blanks.

_____19. Keeps a protective film on moving parts

_____20. Resists breakdown at high temperatures

_____21. Resists corrosion and rusting

_____22. Prevents carbon build-up

_____23. Flows easily at low temperature

_____24. Flows easily at high temperatures

_____25. Resists foaming

_____26. Resists breakdown after long use

Part 5. Match oil additives below with their correct functions.

A. Anti-rust
B. Oxidation inhibitor
C. Anti-corrosion
D. Viscosity index improver
E. Pour point depressant
AB. Extreme pressure
AC. Foam inhibitor
AD. Detergent-dispersant

_____27. Helps prevent failure of alloy bearings from corrosive acids caused by combustion

_____28. Prevents acid, varnish and sludge formations

_____29. Prevents rusting of metal parts during storage or downtime

_____30. Helps oil give top lubricating protection at both high and low temperatures

_____31. Prevents wax crystals from congealing in cold weather and forming clumps

_____32. Assures lubrication where extreme pressures between close tolerances are encountered

_____33. Helps keep metal surfaces clean and prevents deposit formation

_____34. Helps prevent air bubbles that would restrict lubrication

Part 6. Select factual statements about oil by placing an "X" in the appropriate blanks.

_____35. Oil becomes unfit for further use as it absorbs contaminants and as additives are depleted

_____36. Multi-viscosity oils are not always preferred

_____37. Black oil does not mean time for an oil change

_____38. Buy quality oil filters as recommended by machine operator's manual

_____39. Oil oxidation results in thicker oil

_____40. Using a light oil until consumption increases, and then switching to a heavier oil, is not a good practice

_____41. Following operator's manual recommendations is critical to insure good performance

Part 7. Complete the following list of statements concerning the selection and use of oils for best engine performance by selecting the letter of the appropriate response from the list below.

A. plugged
B. specifications
C. manufacturer's
D. contaminators
E. Drain
AB. tested
AC. temperature

_____42. Use brands that meet engine_____________specifications.

_____43. _________________and change at recommended intervals.

_____44. Select oils that have been_________________.

_____45. Never mix oils of various_______________.

_____46. Bring engine up to normal operating______________ each time it is used.

_____47. Use clean oil containers and keep covered, sealed and protected to prevent______________________.

_____48. Replace or clean filters before they become__________.

Part 8. Select true statements concerning two-cycle oil selection by placing an "X" in the appropriate blanks.

_____49. Select only manufacturer's recommended rating

_____50. Select only oil recommended for use in either air cooled or water cooled two-cycle engines

_____51. Use oil-fuel mixture recommended by manufacturer

_____52. Use oils that are close to manufacturer's recommendations

_____53. Never mix synthetic oils with mineral oils

Part 9. List four oil contaminants.

____

____

____

____

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

ANSWERS TO UNIT I, LESSON 2 TEST

Part 1.

1. B
2. A
3. D
4. C
5. E
6. AD
7. AB
8. AC
9. B
10. B,C,D

Part 2.

11. C
12. A
13. D
14. B

Part 3.

15. C
16. D
17. B
18. A

Part 4.

19. X
20. X
21. X
22. X
23. X
24.
25. X
26. X

Part 5.

27. C
28. B
29. A
29. A
30. D
31. E
32. AB
33. AD
34. AC

Part 6.

35. X
36. X
37. X
38. X
39. X
40. X
41. X

Part 7.

42. C
43. E
44. AB
45. B
46. AC
47. D
48. A

Part 8.

49. X
50. X
51. X
52.
53. X

Part 9.

Any four of the following:

Foreign particles
Water
Antifreeze
Fuel
Oxidation
Acids

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 3: IGNITION SYSTEMS

LESSON OBJECTIVE

After completion of this lesson, the student will be able to TEST THE COIL, CONDENSER, ARMATURE, AND FLYWHEEL MAGNETS AND REMOVE AND REPLACE CONTACT POINTS AND CONDENSER. The student should also be able to TEST AND ADJUST A SOLID STATE IGNITION SYSTEM AND REMOVE AND REPLACE SPARK PLUGS. Mastery will be evidenced by completion of job sheets and by scoring ________ percent on the lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match the types of ignition systems with their correct descriptions.
2. Distinguish between the components of a primary and secondary battery ignition circuit.
3. Identify the components of a magneto ignition system.
4. Identify the components of a solid state ignition system.
5. Identify the components of a breakerless ignition system.
6. Match the components of the ignition system with their correct purposes.
7. Distinguish between the operational steps of the ignition systems.
8. Remove, service and replace spark plugs.
9. Remove and replace contact points and condenser.
10. Test the coil, condenser, armature and flywheel magnets.
11. Test condenser for leakage or short.

Completion of the requirements of this lesson fulfills competencies I-3, I-6, and I-7 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 3: IGNITION SYSTEMS

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
    1. Primary circuit
    2. Secondary circuit
    3. Magneto ignition system
    4. Principles of a magneto
    5. Principles of a magneto (continued)
    6. Principles of a magneto (continued)

D. Job sheets
    1. Remove, service and replace spark plugs
    2. Remove and replace contact points and condenser
    3. Test the coil, condenser, armature and flywheel magnets
    4. Test condenser for leakage or short

E. Lesson test

F. Answers to lesson test

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 3: IGNITION SYSTEMS

INFORMATION OUTLINE

I. Purpose of the ignition system--produces high voltage current to ignite the fuel-air mixture in the engine cylinder

II. Types of ignition systems

- A. Battery ignition system--uses battery to supply source of current for the primary ignition circuit
- B. Magneto ignition system--produces current by magnetic induction for the primary ignition circuit without any outside source of electricity
- C. Solid state ignition system--uses semiconductors in place of one or more standard ignition components
- D. Breakerless ignition system--uses electronic parts in place of mechanically operated ignition points

III. Battery ignition systems circuit components (TM 1, TM 2)

- A. Primary circuit (low voltage)
  1. Battery
  2. Ignition switch
  3. Resistance unit (resistor)
  4. Primary winding
  5. Contact points
  6. Condenser
  7. Low voltage wire
- B. Secondary circuit (high voltage)
  1. Secondary winding
  2. Distributor cap
  3. Rotor
  4. Spark plug
  5. High voltage wire

IV. Components of a magneto ignition system (TM 3)

- A. Primary system (low voltage)
  1. Flywheel with magnets
  2. Armature (laminated)
  3. Switch stop
  4. Coil

        5. Contact points
        6. Condenser

    B. Secondary system (high voltage)
        1. Spark plug
        2. High voltage wire

V. Components of a solid state ignition system

    A. Flywheel with magnets

    B. Trigger coil

    C. Resistor

    D. Transistorized rectifier (solid state switch)

    E. Diode rectifier

    F. Ignition coil

    G. Low voltage wire

    (Note: The same secondary circuit components are used on the solid state ignition system that are used on the magneto ignition system)

VI. Components of a breakerless ignition system

    A. Battery

    B. Flywheel

    C. Trigger module

    D. Ignition switch

    E. Alternator-stator

    F. Ignition coil assembly

    G. Rectifier-regulator

    H. Low voltage wire

    I. Silicon rectifier (SCR)

    (Note: The same secondary circuit components are used on the breakerless ignition system that are used on the magneto ignition system)

VII. Purposes of the ignition system components

A. Battery--source of electrical power

B. Ignition switch--opens and closes the primary circuit from the battery or coil to the contact points

C. Coil--transforms low voltage into high voltage necessary to jump the spark plug gap

D. Contact points--make and break the primary circuit to allow the coil to produce high voltage at the spark plug

E. Condenser--stores extra current as the contact points open to prevent arcing and burning

F. Breaker cam--opens the contact points

G. Diode rectifier--changes alternating (AC) current to direct (DC) current

H. Capacitor--used in solid state ignition systems and operates like the condenser

I. Trigger coil--generates a small amount of current that is used to activate the current from the capacitor

J. Resistor--reduces voltage in the primary circuit to protect the contact points

K. Spark plug--provides a spark gap inside the engine cylinder to ignite the fuel-air mixture

L. Low voltage wire--carries low voltage from the battery or armature to the primary side of the ignition coil

(Note: This is a wire with thin insulation.)

M. High voltage wire--carries high voltage from the secondary side of the coil to the spark plug

(Note: This is a heavily insulated wire)

VIII. Operation of the ignition systems (TM 4, TM 5, TM 6)

A. Battery
   1. With the ignition switch on and the contact points closed, low voltage current flows from the battery through the primary windings of the coil and through the contact points to ground
   2. The flow of low voltage current through the primary windings of the coil causes a magnetic field buildup
   3. As the contact points open, current attempts to continue to flow across the point surfaces; the condenser is attached to the points to absorb this flow of current to prevent arcing
   4. Stopping the flow of current causes the magnetic field of the coil to collapse across the secondary coil windings, causing a high voltage surge
   5. The high voltage surge is directed from the secondary windings of the coil through the distributor cap and rotor and on to the spark plug to ground

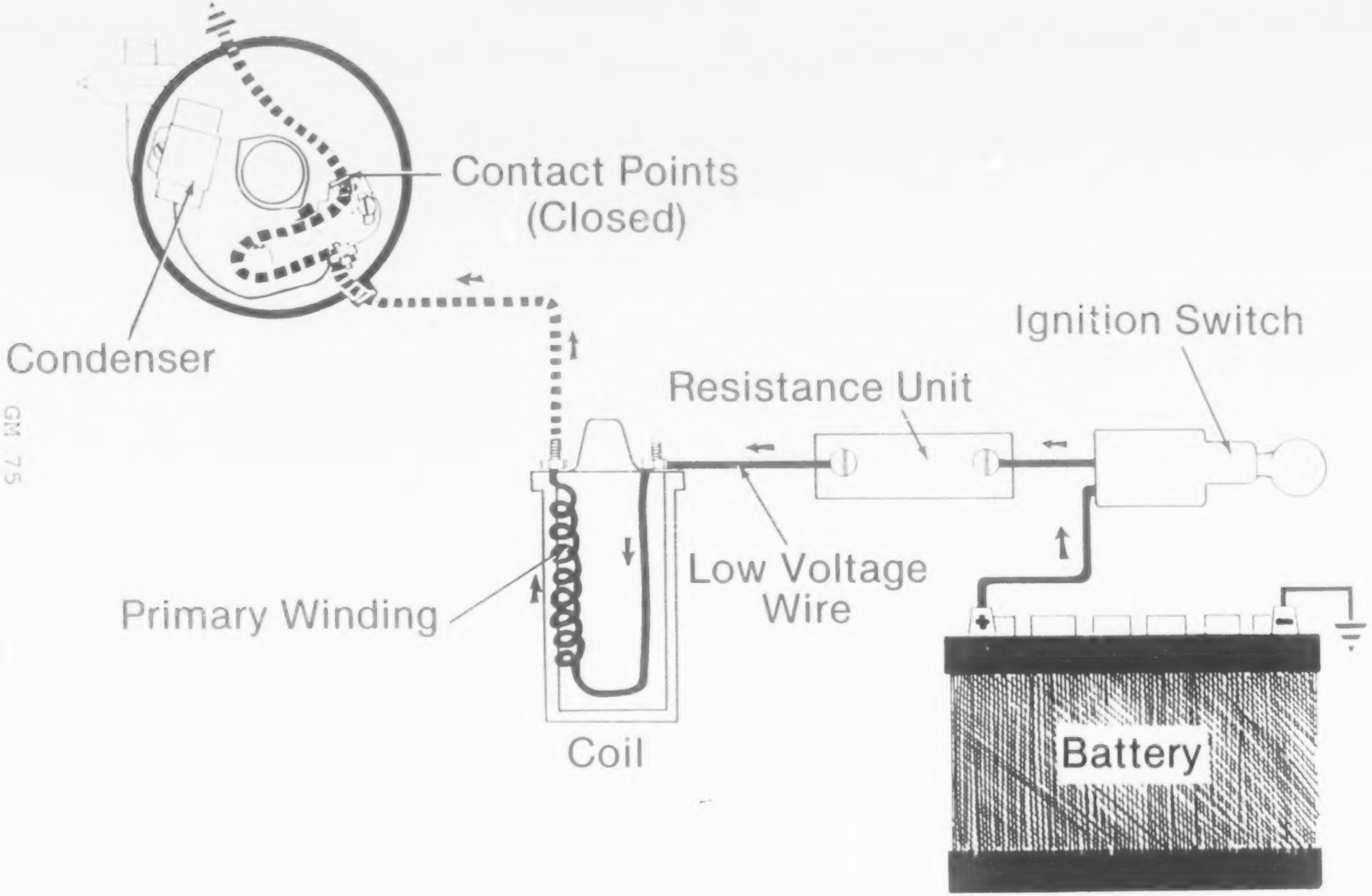
B. Magneto
   1. With the ignition switch on or the contact points closed, low voltage current is induced by magnets through the primary windings of the coil and through the contact points to ground
   2. The flow of low voltage current through the primary windings of the coil causes a magnetic field buildup
   3. As the contact points open, current attempts to continue to flow across the point surfaces--the condenser is attached to the points to absorb this flow of current to prevent arcing
   4. Stopping the flow of current causes the magnetic field of the coil to collapse across the secondary coil windings, causing a high voltage surge
   5. The high voltage surge is directed from the secondary windings of the coil through the secondary wire on to the spark plug to ground

C. Solid state
   1. With the ignition switch on, low voltage current from the flywheel magnet induces alternating current (AC) in charge coil
   2. The AC current passes through a rectifier and changes to direct current (DC), which travels to the capacitator (condenser) where it is stored
   3. The flywheel magnets pass the trigger coil and induce a small electrical charge, which turns on the silicon-controlled rectifier (SCR)

(Note: This completes the circuit from the charged side of the high-tension coil to the negative side of the capacitor)

4. The instantaneous discharge of energy induces a very high density magnetic field around the primary winding of the coil, which cuts the secondary winding and thus creates sufficient energy to fire the spark plug

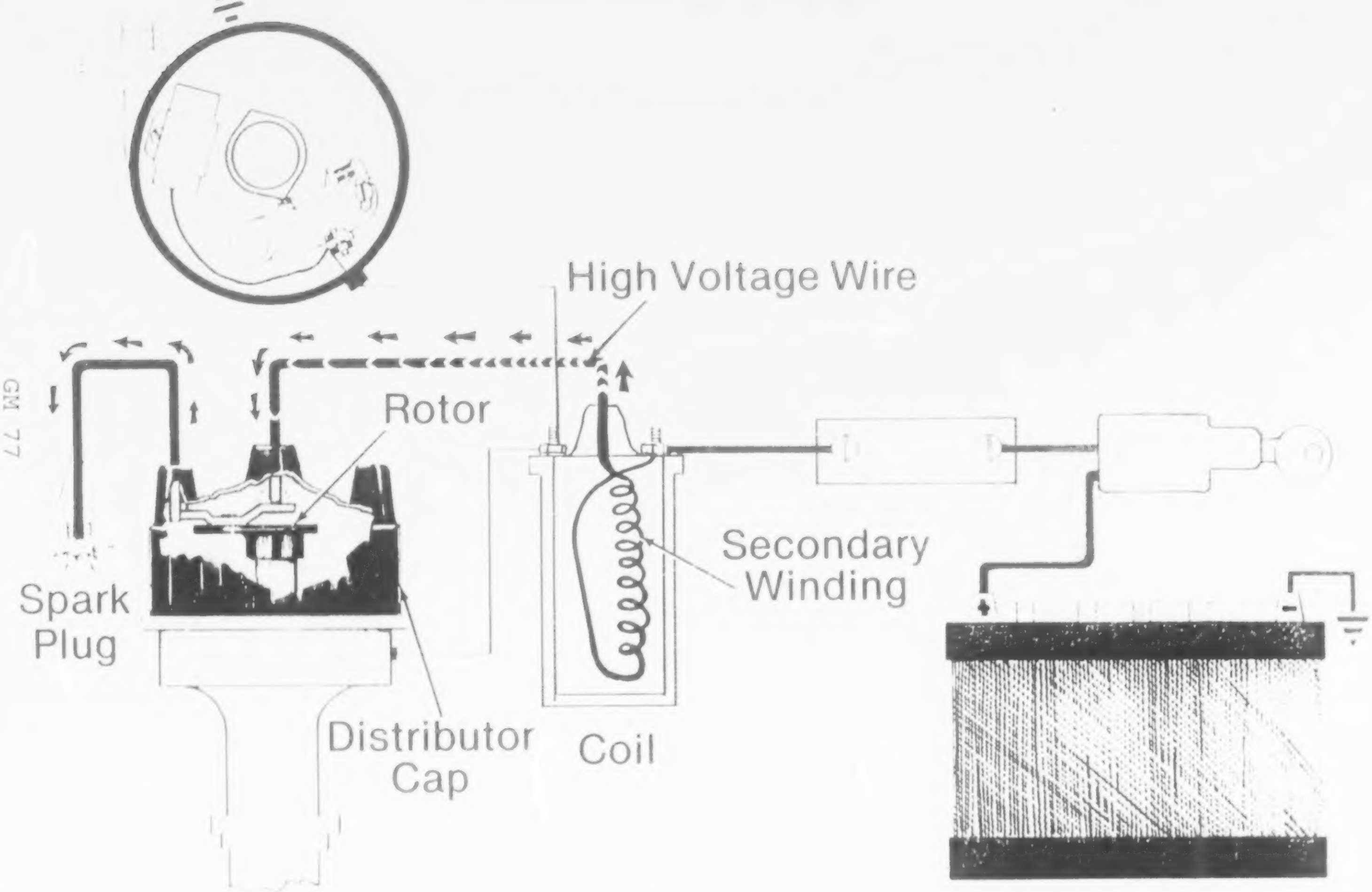
Primary Circuit


Contact Points
(Closed)
Condenser
Ignition Switch
Resistance Unit
Low Voltage
Wire
Primary Winding
Coil
Battery
+
-

GM 75

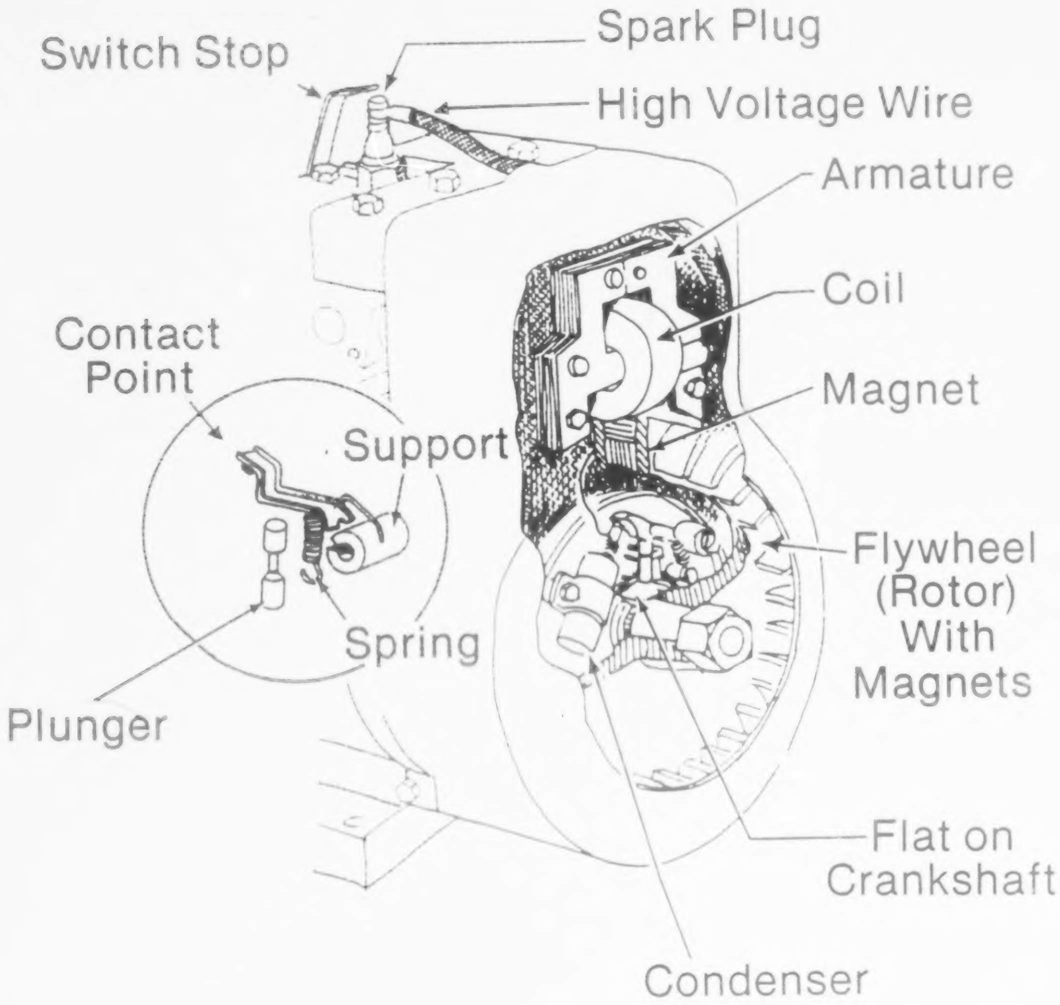
TM 1

Secondary Circuit

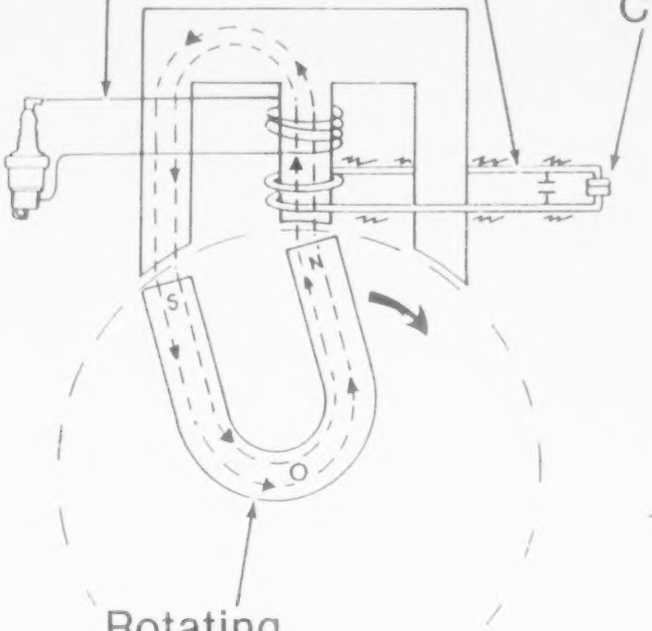

High Voltage Wire
Rotor
Secondary Winding
Spark Plug
Distributor Cap
Coil
GM 77

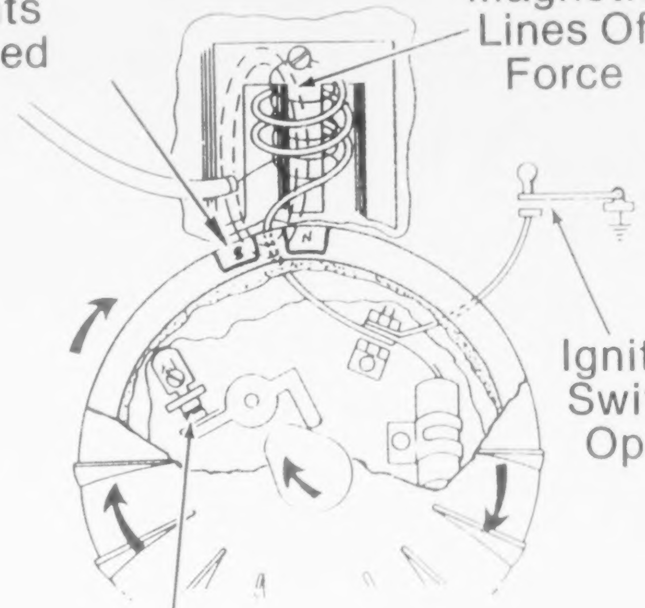
TM 2

Magneto Ignition System


Switch Stop
Spark Plug
High Voltage Wire
Armature
Coil
Contact Point
Support
Magnet
Flywheel (Rotor) With Magnets
Spring
Plunger
Flat on Crankshaft
Condenser

Principles of a Magneto


Secondary Circuit
Primary Circuit
Contact Points Closed
S
N
Rotating Permanent Magnet

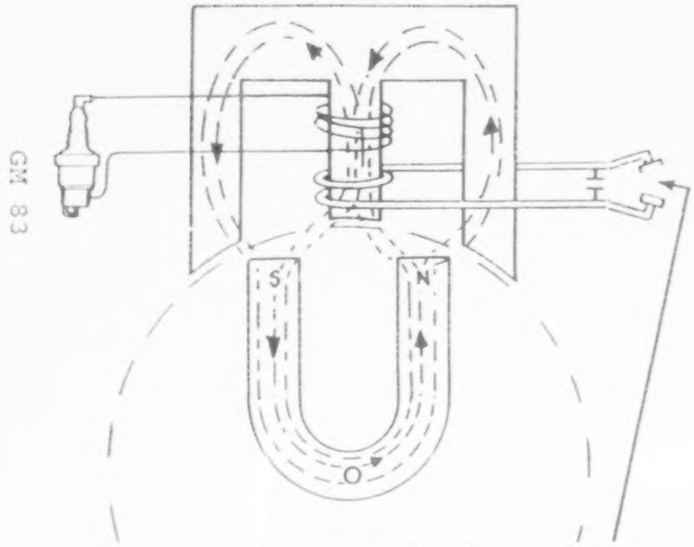

Permanent Magnet
Magnetic Lines Of Force
S
N
Ignition Switch Open
Contact Points Closed

GM 81

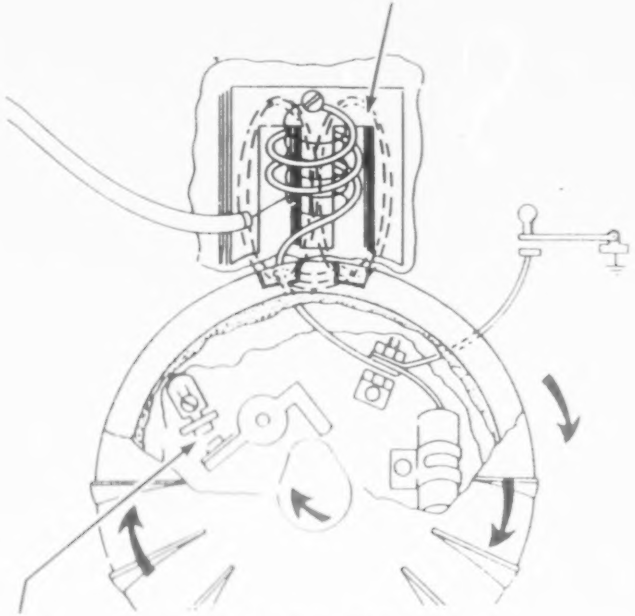
TM 4

Principles of a Magneto

(Continued)



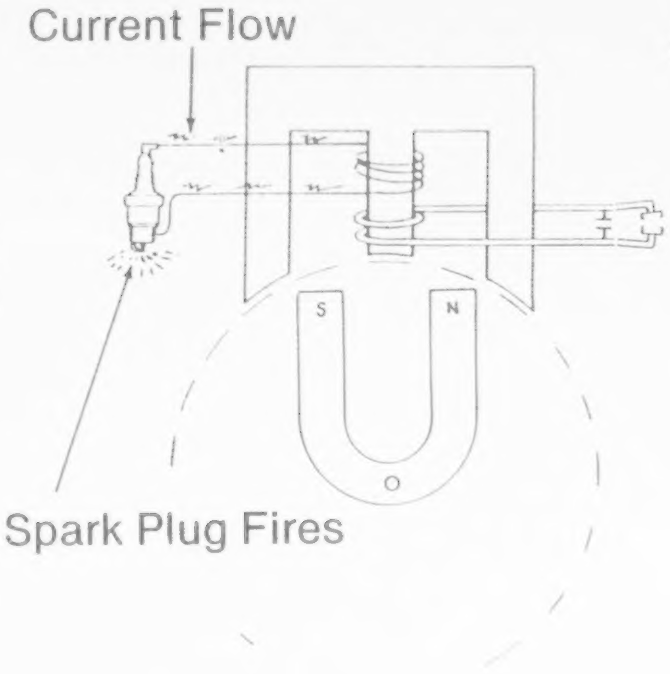
Contact Points Open

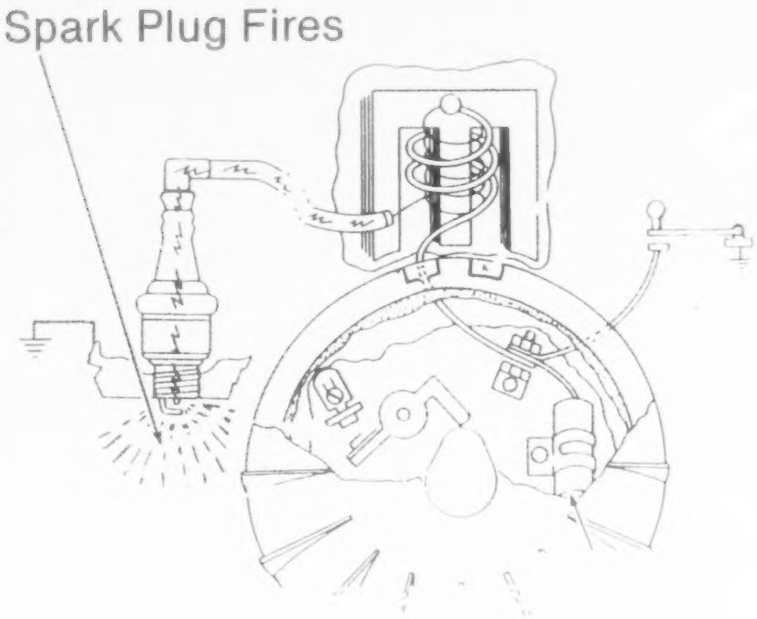


Contact Points Open

Principles of a Magneto

(Continued)


Current Flow
S
N
Spark Plug Fires


Spark Plug Fires

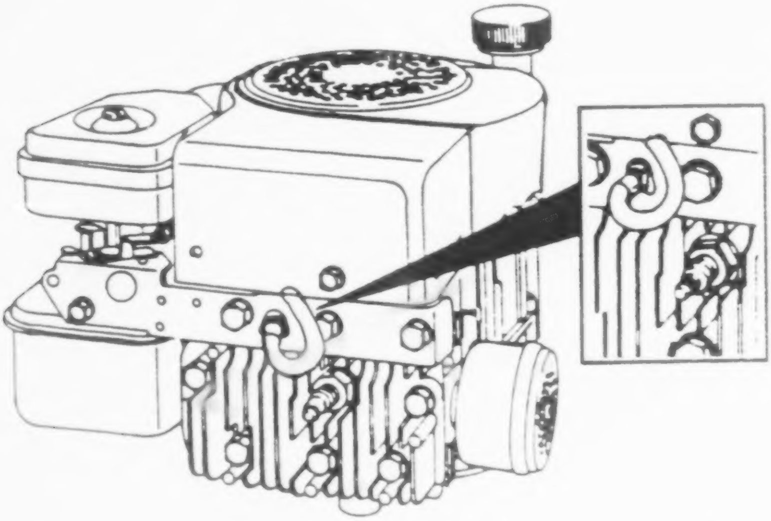
GM 85

REMOVE, SERVICE AND REPLACE SPARK PLUGS

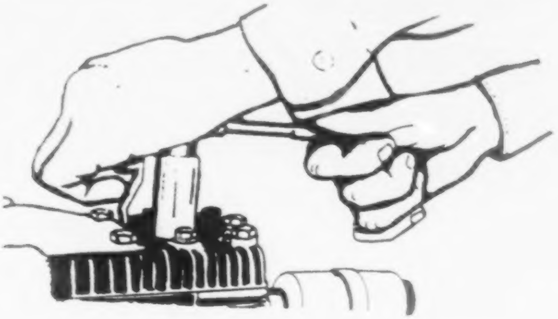
Equipment:

Hand tool assortment
Wire feeler gauge
Ignition file
Wire brush
Spark tester
Safety glasses

Procedure:	Evaluation			
	3	2	1	N
1. Clean around spark plug by blowing out dirt with compressed air.	___	___	___	___
2. Secure engine to be serviced and disconnect spark plug wire. Secure the wire in the V-notch above the spark plug or tape the wire in place on older models.	___	___	___	___

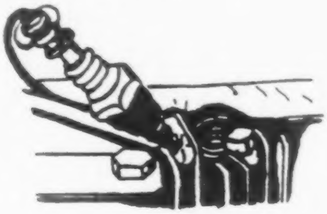


3. Loosen the spark plug one turn and blow any trapped dirt out with compressed air. Remove spark plug. ___ ___ ___ ___



4. Reconnect spark plug wire. ___ ___ ___ ___

5. Ground spark plug to engine. ___ ___ ___ ___



6. Crank engine one or two turns. ___ ___ ___ ___

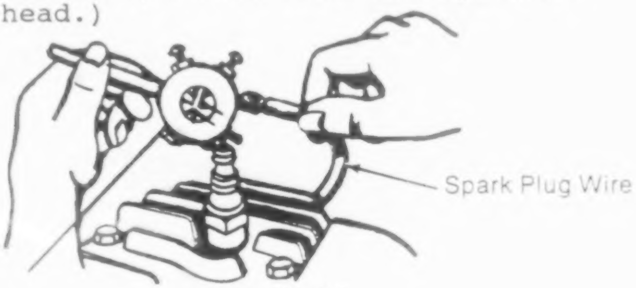
7. Observe spark at the electrode. ___ ___ ___ ___

(Note: If there is no spark or the spark
is weak, proceed to next step.)

8. Disconnect the spark plug wire from the spark plug. ___ ___ ___ ___

9. Use spark tester to check ignition. ___ ___ ___ ___

(Note: Do not hold end of spark plug wire
within 1/4 inch from the cylinder
head.)



GM 88

10. Crank the engine one or two turns. — — — —

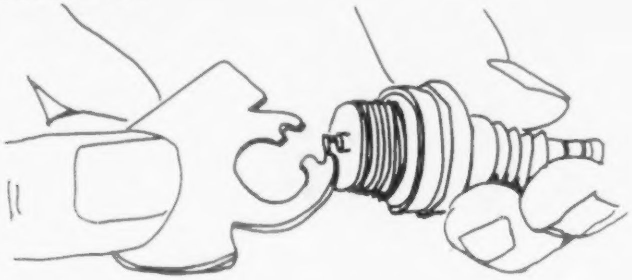
11. Observe the spark. — — — —

    (Note: If spark jumps gap on tester, the ignition system is OK; the trouble is in the spark plug.)

12. Service the spark plug. Begin by cleaning the threads with a wire brush. — — — —

    (Note: Using a spark plug cleaning machine is not recommended because this will void small engine warranties.)

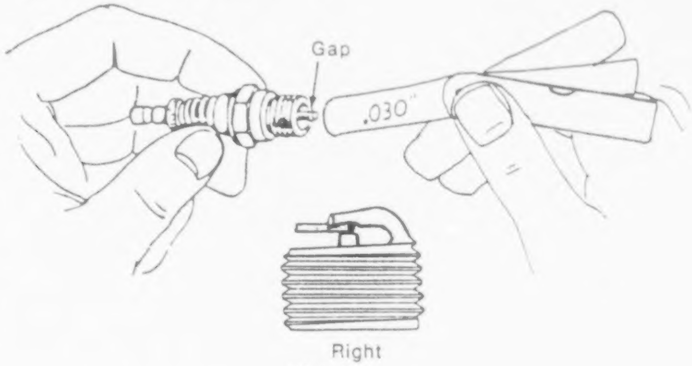
13. With a gap setter, bend the ground electrode away from the central electrode just enough to allow the ignition file to fit between the two electrodes. — — —



14. Using the ignition file, file the ground and central electrode until both have flat, shiny surfaces. — — — —

15. Bend the ground electrode back into its original position. Gap plugs to manufacturer's specifications. — — — —

    (Note: Use a wire gauge and bend only the ground electrode.)



GM 89

16. Install spark plug by hand until seated snugly, then tighten. ___ ___ ___ ___

(Note: Use caution when starting the spark plug to avoid cross threading.)

17. Torque the spark plug to manufacturer's recommendations. ___ ___ ___ ___

18. Replace the spark plug wire. ___ ___ ___ ___

19. Have instructor evaluate work. ___ ___ ___ ___

20. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ___ ___ ___

Average of above evaluations* ___ ___ ___ ___

This average is the student's partial evaluation for competency I-3 of Building Maintenance.

REMOVE AND REPLACE CONTACT POINTS AND CONDENSER

Equipment:

Flywheel removal tools
Ignition tools and wrenches
Feeler gauge set .010 - .025
Screwdrivers
Cam lubricant
Shop towels
Electrical cleaner
Hand tool assortment
Safety glasses

Procedure:

Evaluation
3 2 1 N

REMOVAL (applies to Briggs and Stratton only)

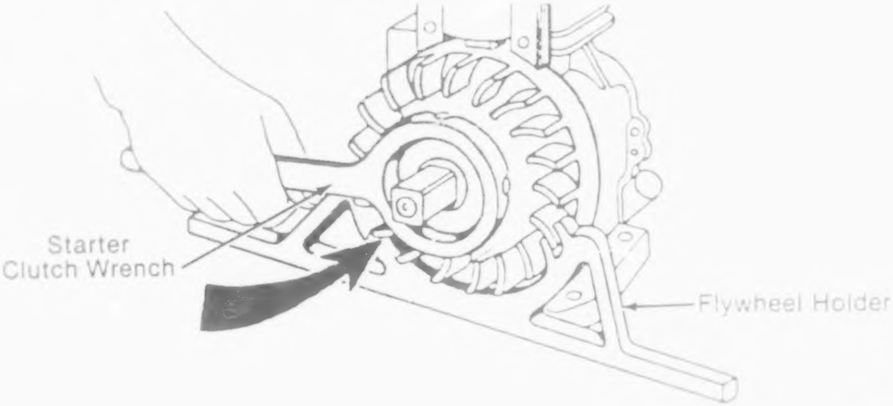
1. Find location of points and condenser. ___ ___ ___ ___

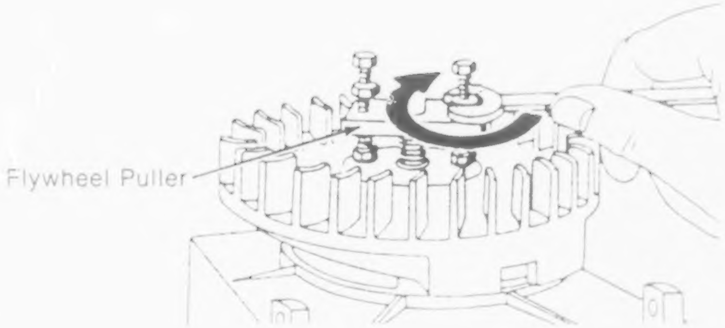
   (Note: On most engines this will be under the flywheel. Some will be located externally on the side of the block.)

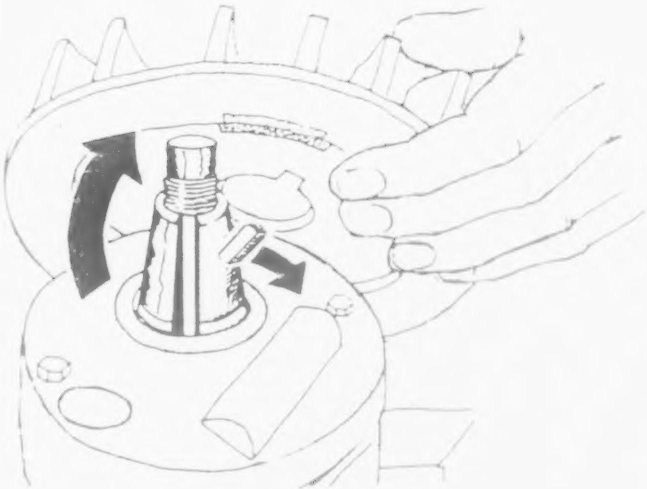
2. Remove engine shroud and any parts necessary to get at the flywheel.

3. Remove flywheel.

   (Note: Check for left-hand threads on crankshaft. Use special flywheel removal tools as required.



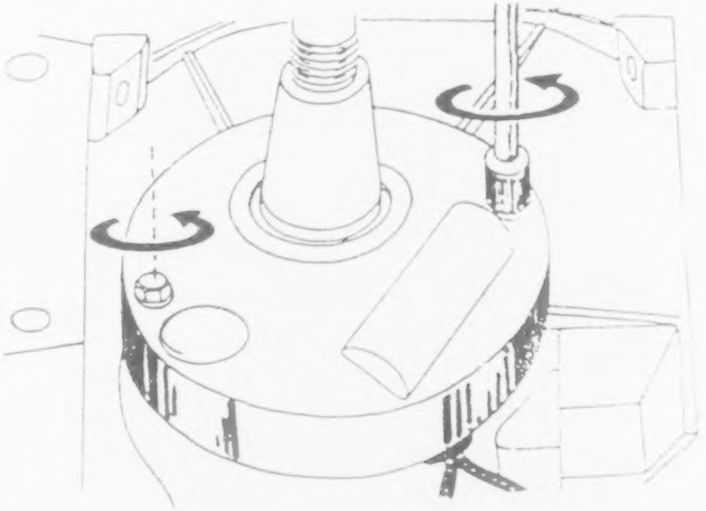




(Note: Check condition of flywheel keyway and magnet. If the magnet is rusty, clean with emery cloth and cleaner brush. Check key closely for damage. If damaged, replace with new key.)

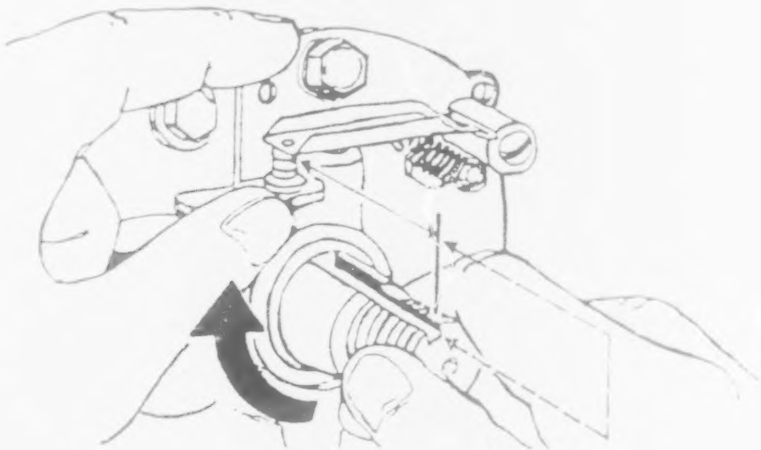
4. Remove breaker point dust cover. — — — —

(Note: Some covers have a sealer at the point where the wires enter. Save this for reuse.)

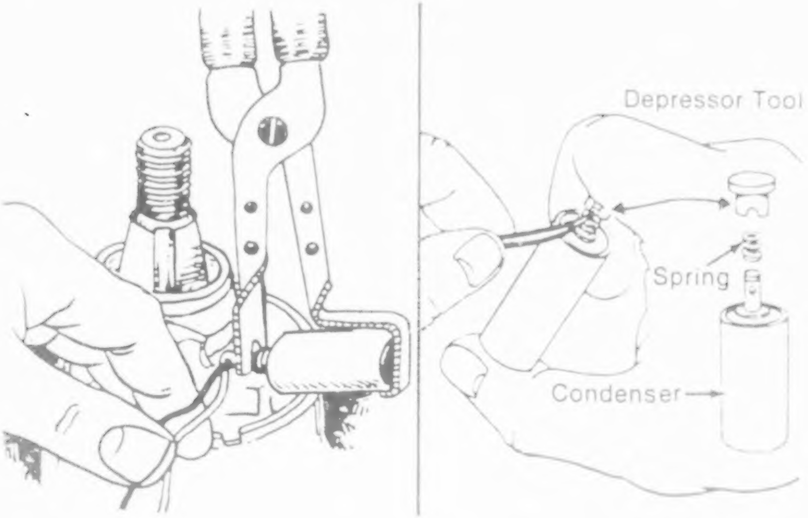


5. Determine location and condition of all wires, screws and breaker cam. — — — —

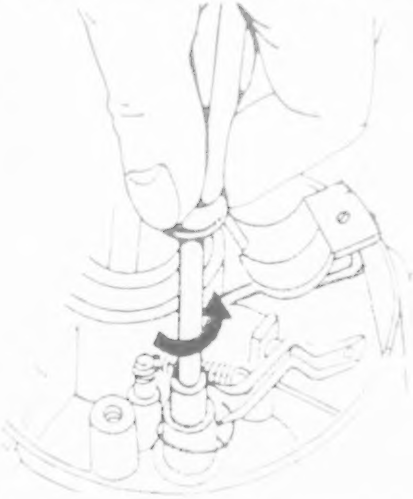
(Note: Turn crankshaft clockwise with your hand until keyway is in line with the breaker plunger. At this point cam is at its highest position.)



6. Remove screw holding condenser in place. Using the depressor tool, disconnect contact point primary lead and ground wire.

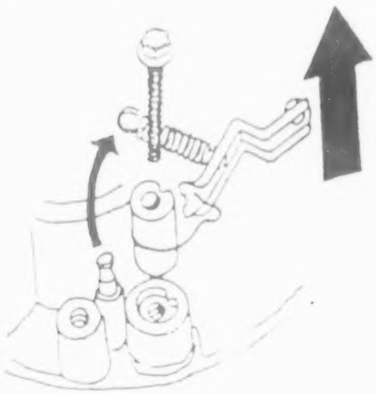

Depressor Tool
Spring
Condenser

7. Loosen mounting bolt and remove the movable contact point.



(Note: When mounting bolt is loosened, the contact point loses its tension.)

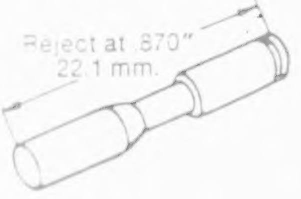
8. Lift spring from post and remove mounting bolt, contact point, mounting post and spring. — — — —



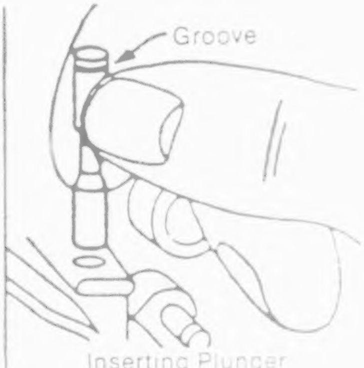
(Note: Keep the mounting bolt. Always replace old contact points with a new set.)

9. Inspect the breaker point plunger. — — — —

(CAUTION: The plunger must be inserted with groove at the top when installed or oil will enter the breaker box.)



Checking Plunger



Inserting Plunger

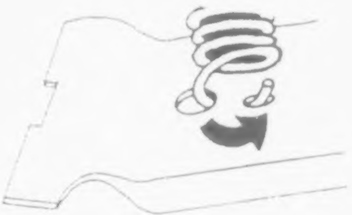
10. Clean the point and condenser area with approved electrical cleaner. — — — —

(Note: Check the oil seal located in the point area to be sure it is not leaking oil onto the points.)

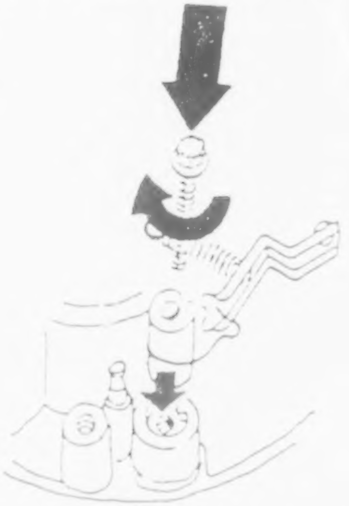
11. Lubricate the breaker cam with a light coating of cam lubricant. ___ ___ ___

REASSEMBLY

12. Install new movable contact point. Hook open loop of spring through large hole then through small hole. ___ ___ ___ ___

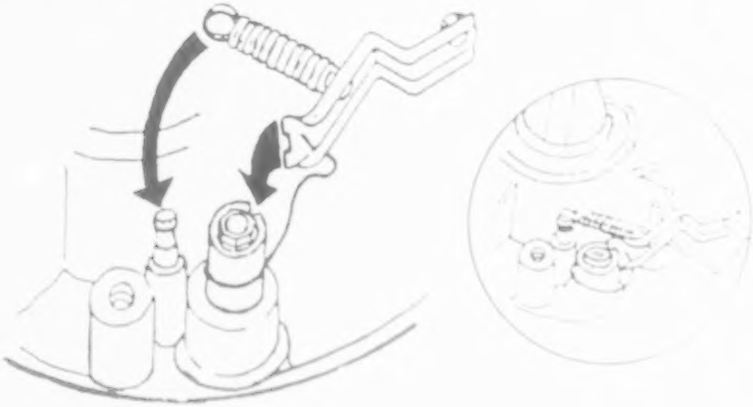


13. Place mounting bolt into post and tighten. ___ ___ ___ ___

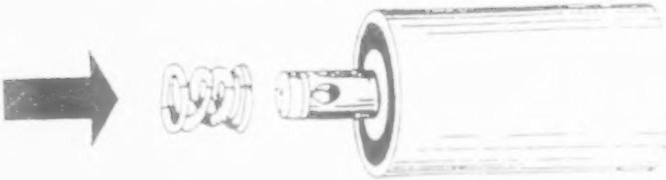


(Note: Handle movable point carefully to prevent breaking wire connection to post.)

14. Fit end of contact point arm into groove in mounting post. Hook closed loop of spring onto the small post. _ _ _ _

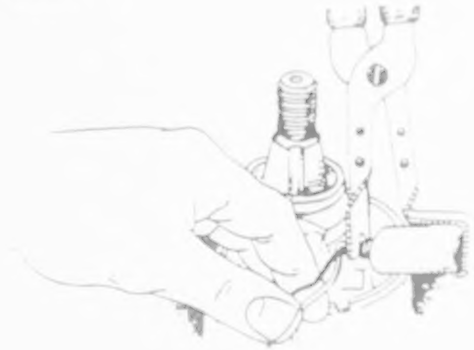


15. Place spring on condenser and hold it in place. _ _ _ _

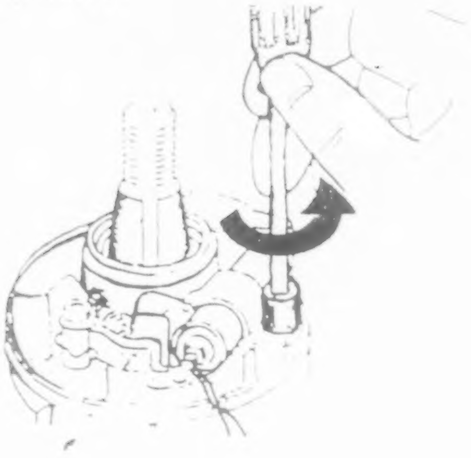


(Note: Flatten wire ends around fixed point.)

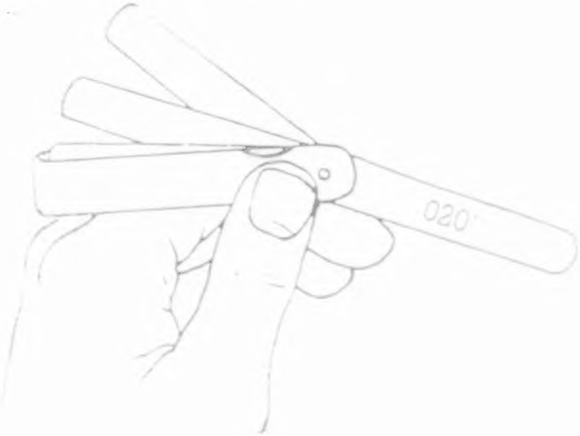
16. Compress spring and slip the two wires into the hole on condenser. _ _ _ _



17. Install new condenser and clamp in place.
Tighten the clamp bolt. __ __ __ __



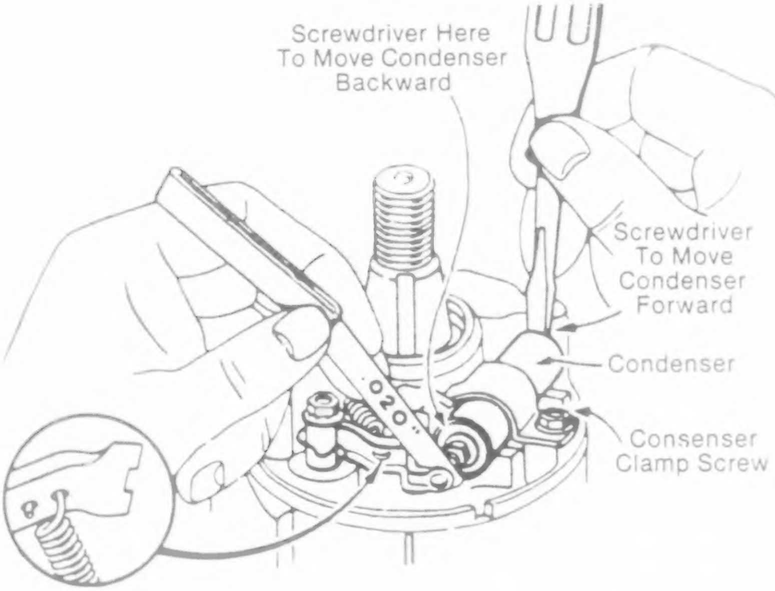
18. Select correct size feeler gauge. __ __ __ __



(Note: Make sure the crankshaft keyway is lined up with the breaker plunger.)

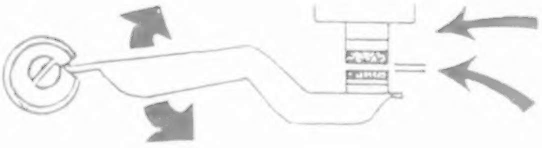
19. Tighten the condenser clamp. Place feeler gauge between contact points; push condenser forward with a screwdriver; set the points at .020. __ __ __ __

(Note: Make sure condenser clamp is secured. The condenser should move back and forth to set points properly.)

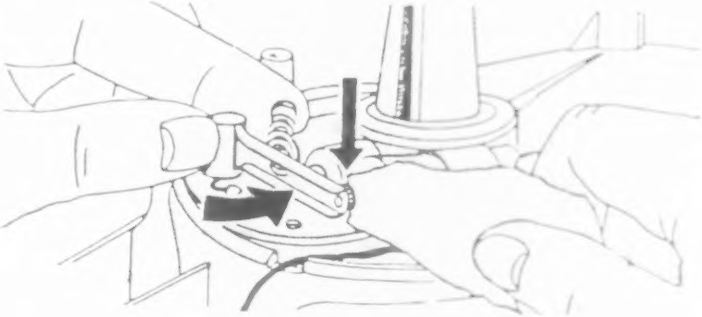


Screwdriver Here To Move Condenser Backward
Screwdriver To Move Condenser Forward
Condenser
Consenser Clamp Screw
.020"

20. Make sure the two contact points fit squarely together and not at an angle. Adjust the movable contact point if necessary. __ __ __ __



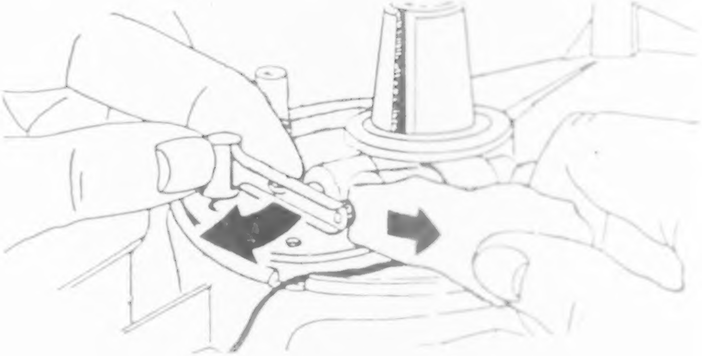
21. Open the points and place a piece of paper between the points. Close the points with paper still between them as this removes any grease on the points. __ __ __ __



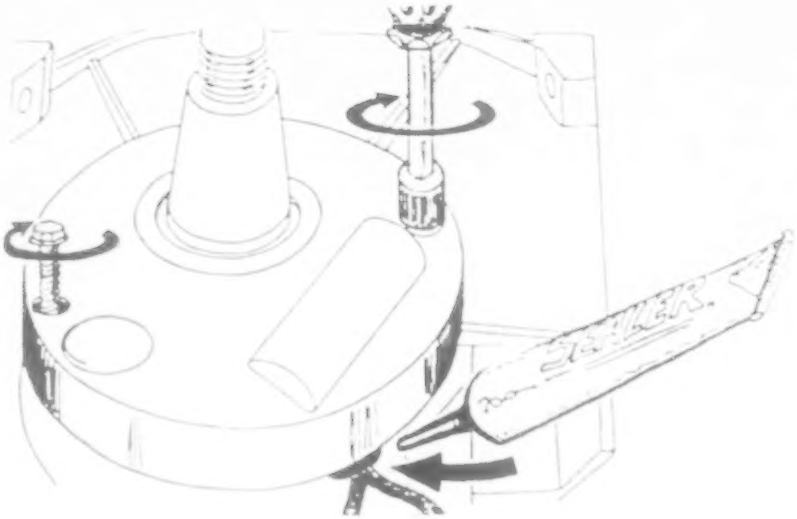
(Note: Use a nonfibrous paper.)

22. Open points and remove the paper. __ __ __ __

(CAUTION: Always open points when removing paper.)

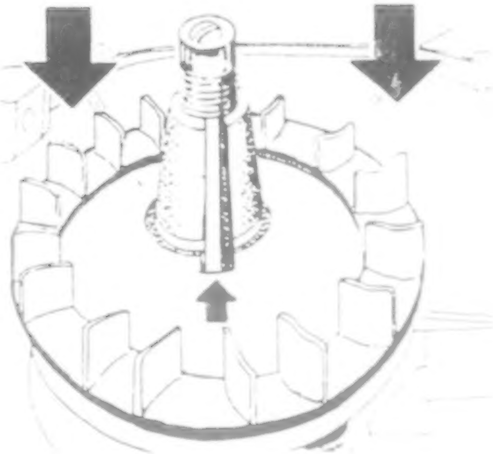


23. Place sealer around wiring. Replace dust cover and bolts on the points and condenser. — — — —

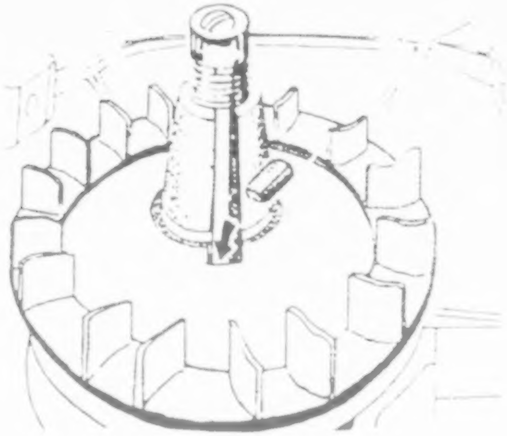


(Note: Do not overtighten the bolts because they will strip easily.)

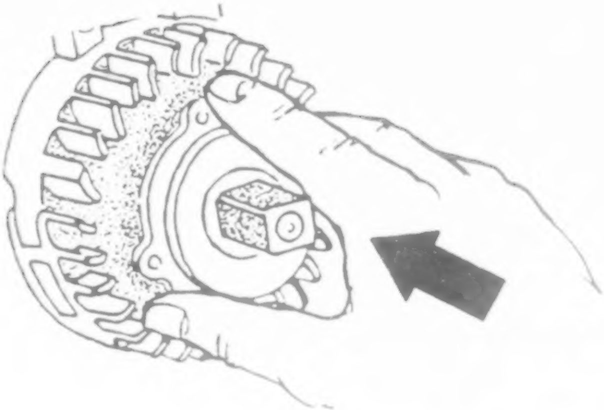
24. Place flywheel on crankshaft and line up the keyway. — — — —



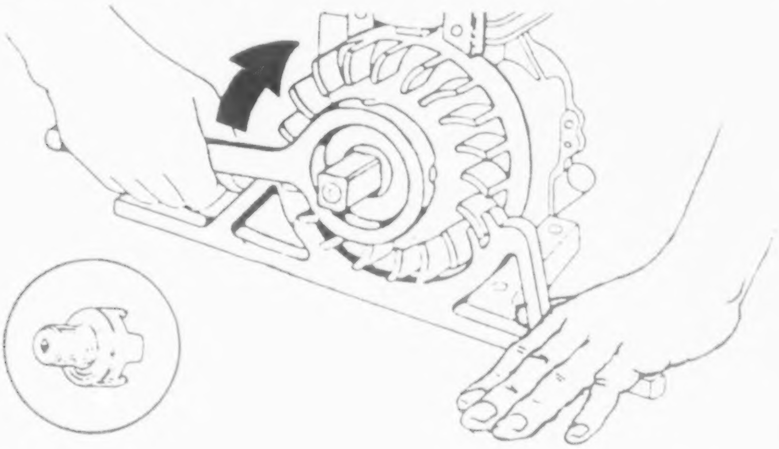
25. Place flywheel key in keyway. — — — —



26. Place starter clutch onto crankshaft. — — — —

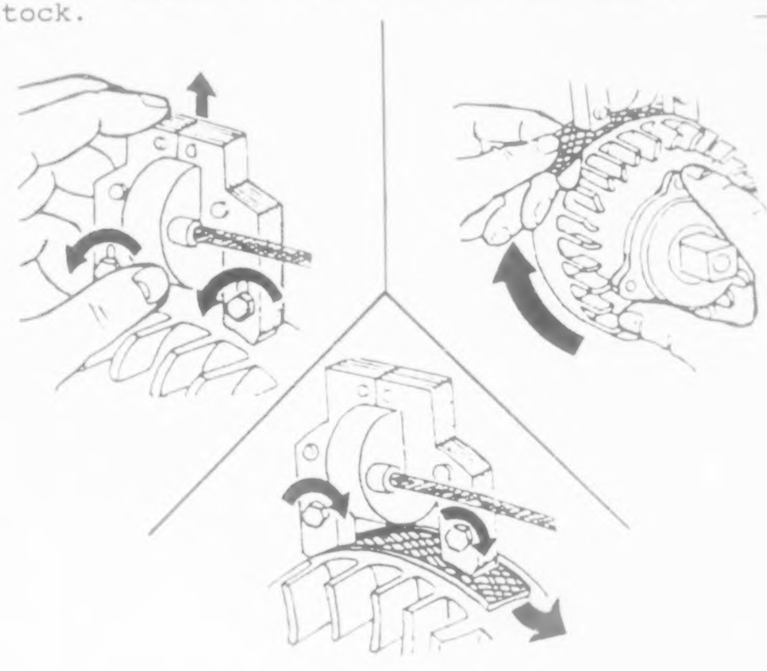


27. Place flywheel holder on flywheel and starter clutch wrench on starter clutch. While holding the flywheel holder, tighten starter clutch. — — — —



(Note: Torque flywheel to 55 ft.-lbs. using starter clutch wrench with 1/2" drive torque wrench.)

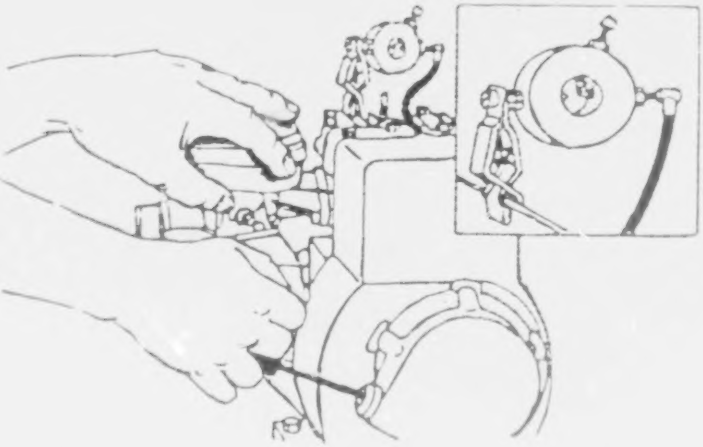
28. Check air gap by loosening the two armature bolts, inserting .010 shim stock between flywheel and armature, and rotating the flywheel until magnets pull armature over to shim stock. Tighten armature bolts and remove shim stock. — — — —



29. Attach flywheel screen over starter clutch. ___ ___ ___ ___

30. Replace flywheel shroud and tighten the bolts. ___ ___ ___ ___

31. Check out ignition. ___ ___ ___ ___



(Note: Spark should be a bright blue and jump the .166" tester gap.)

32. Reconnect the spark plug wire. ___ ___ ___ ___

33. Have instructor evaluate work. ___ ___ ___ ___

34. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ___ ___ ___ ___

Average of above evaluations* ___ ___ ___ ___

*This average is the student's partial evaluation for competency I-7 of Building Maintenance.

TEST THE COIL, CONDENSER, ARMATURE AND FLYWHEEL MAGNETS

Equipment:

Hand tool assortment
Ignition analyzer
Small, thin cardboard (post card)
Electrical system cleaner
Shop towels
Safety glasses

Procedure:

Evaluation
3 2 1 N

1. Remove all parts necessary to get at coil and armature. ___ ___ ___ ___

2. Determine correct location of coil and armature. ___ ___ ___ ___

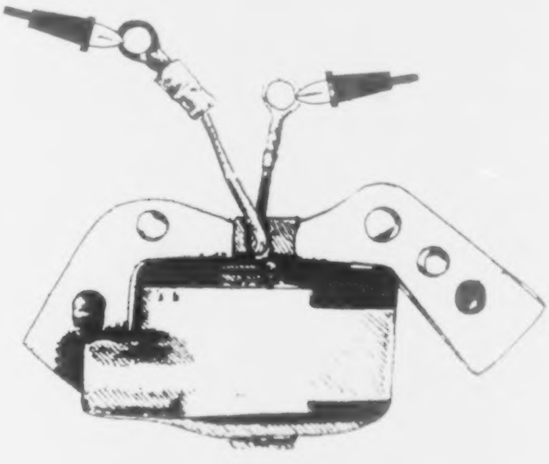
   (Note: If there are no locating marks (arrows, dots, etc.) to locate coil or armature accurately, mark it and the engine block before removing. Use a small center punch or chisel for marking.)

3. Remove coil and armature. ___ ___ ___ ___

   (Note: It is possible to test the coil and armature without removing it from the engine.)

TEST COIL AND ARMATURE

4. Test primary resistance: Following instructions for tester, connect leads. ___ ___ ___ ___



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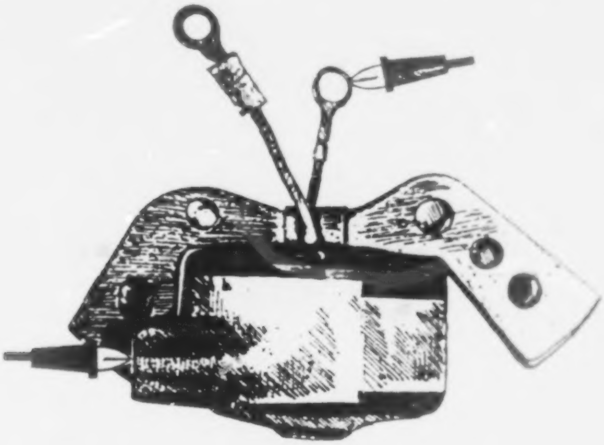
5. Read ohmmeter. ____

(Note: Reading must be of value shown on engine specification sheet.)

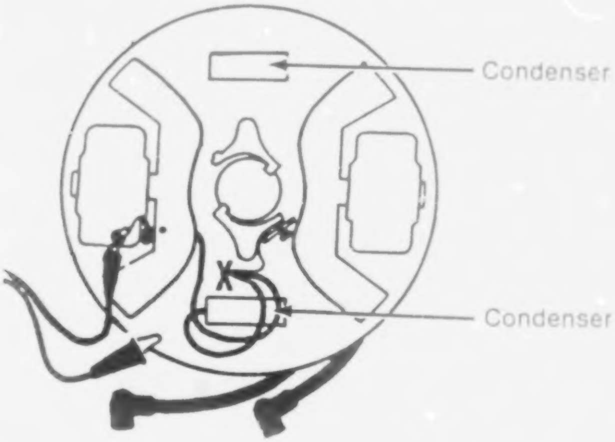
6. Test continuity: Following instructions for tester, connect leads. ____



7. Read ohmmeter. ____

(Note: Shorted windings are indicated by a lower than specified value. A broken winding is indicated by readings higher than the specified value.)

8. Test coil ground following instructions for tester, connect leads. ____



9. Read ohmmeter. ____ ____ ____ ____

   (Note: Coils not permanently grounded should not indicate any pointer movement when tested. Coils permanently grounded must show a full deflection of the meter needle to the right of the scale.)

10. Test power: Following instructions for tester, properly connect test leads. ____ ____ ____ ____

11. Advance current control knob until specified operating amperage is reached on scale. ____ ____ ____ ____

    (Note: If there is no spark, or if it is faint or intermittent, the coil is bad.)

12. If the coil fails any of the tests, replace it with a new coil. ____ ____ ____ ____

13. Replace all defective parts. ____ ____ ____ ____

14. Test flywheel magnets. ____ ____ ____ ____

    (Note: Hold a screwdriver one inch from the magnet. It should be strongly attracted to the magnet. Most magnets are damaged by dropping the flywheel, or storing flywheels nested in one another.)

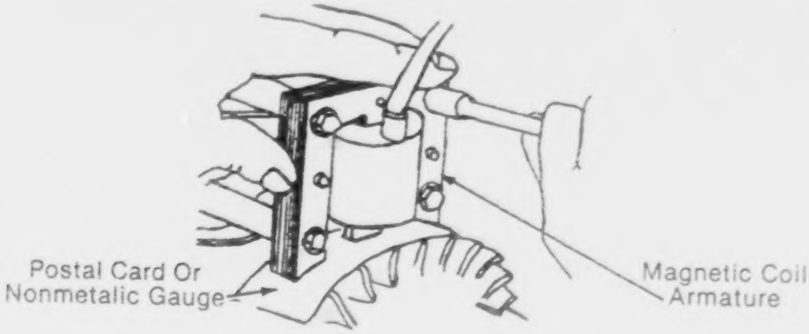
15. Replace bad magnets. ____ ____ ____ ____

    (Note: Usually the whole flywheel must be replaced.)

16. Install coil and armature in correct position. ____ ____ ____ ____

    (Note: Do not overtighten mounting screws because these threads are easy to strip.)

17. Follow manufacturer's specifications for clearances, adjustments and torque setting. ____ ____ ____ ____


Postal Card Or
Nonmetalic Gauge
Magnetic Coil
Armature

18. Install all other parts on engine. ____ ____ ____ ____

19. Start engine and adjust to recommended specifications. ____ ____ ____ ____

20. Have instructor evaluate work. ____ ____ ____ ____

21. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ____ ____ ____ ____

Average of above evaluations* ____ ____ ____ ____

*This average is the student's partial evaluation for competency I-6 of Building Maintenance.

TEST CONDENSER FOR LEAKAGE OR SHORT

Equipment:

Hand tool assortment
Ignition analyze
Safety glasses
Shop towels

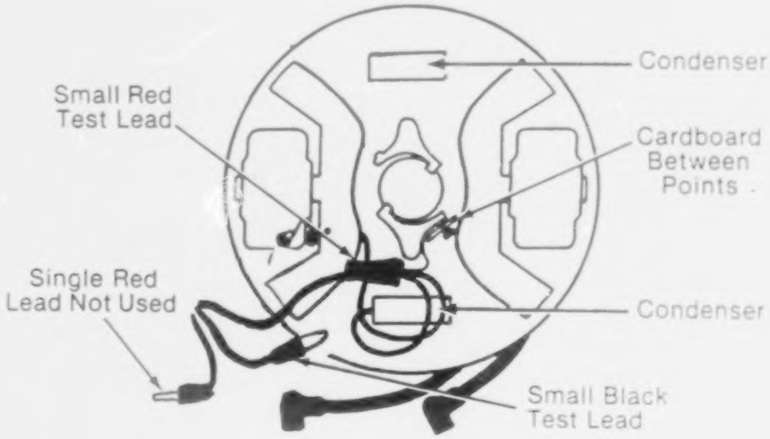
(Note: The Merc-O-Tronic Ignition Analyzer is used in this job sheet.)

Procedure:

Evaluation
3 2 1 N

1. Remove all parts necessary to get at ignition system. — — — —

2. Read operator's manual and determine correct location of ignition parts and the method of making proper connections for testing the condenser. — — — —


Condenser
Small Red Test Lead
Cardboard Between Points
Single Red Lead Not Used
Condenser
Small Black Test Lead

3. Connect small black test lead to stator plate if condenser is counted, otherwise to body of condenser. — — — —

4. Connect small red test lead to breaker terminal, or if unmounted, to condenser lead. — — — —

5. Place a piece of cardboard between breaker points. ___ ___ ___ ___

6. To make the condenser test, cord must be plugged into 115 volt 60-cycle AC outlet. ___ ___ ___ ___

7. Turn selector switch to No. 5 "Leakage" and short. ___ ___ ___ ___

8. Press red button and hold a minimum of 15 seconds. Read scale No. 5. ___ ___ ___ ___

9. The meter pointer hand will move to the right and must return within range of the narrow black bar at the left. ___ ___ ___ ___

   (Note: Any readings that fall to the right of the black bar indicate the condenser is leaking or shorted and must be replaced.

10. Remove all test leads. ___ ___ ___ ___

11. Replace defective condenser. ___ ___ ___ ___

12. Install all other parts on engine. ___ ___ ___ ___

13. Start engine and adjust to recommended specifications. ___ ___ ___ ___

14. Have instructor evaluate work. ___ ___ ___ ___

15. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ___ ___ ___ ___

Average of above evaluations* ___ ___ ___ ___

*This average is the student's partial evaluation for competency I-6 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 3: IGNITION SYSTEMS

LESSON TEST

Part 1. Match the types of ignition systems below with their correct descriptions.

A. Battery ignition system
B. Magneto ignition system
C. Breakerless ignition system
D. Solid state ignition system

_____ 1. Produces current by magnetic induction for the primary ignition circuit without any outside source of electricity

_____ 2. Uses semiconductors in place of one or more standard ignition components

_____ 3. Uses electronic parts in place of mechanically operated ignition points

_____ 4. Uses battery to supply source of current for the primary ignition circuit

Part 2. Distinguish between the components of the primary and secondary battery ignition circuits by placing a "P" in front of the components in the primary ignition circuit and an "S" in front of those in the secondary ignition circuit.

_____ 5. Resistance unit (resistor)

_____ 6. Condenser

_____ 7. Distributor cap

_____ 8. Ignition switch

_____ 9. Rotor

_____10. Secondary winding

_____11. High voltage wire

_____12. Low voltage wire

_____13. Contact points

_____14. Battery

_____15. Primary winding

_____16. Spark plug

Part 3. From the list below, identify the components of a magneto ignition system.

A. Contact points
B. Coil
C. Condenser
D. Switch stop
E. Spark plug
AB. Armature
AC. High voltage wire
AD. Flywheel with magnets

_____17.

_____18.

_____19.

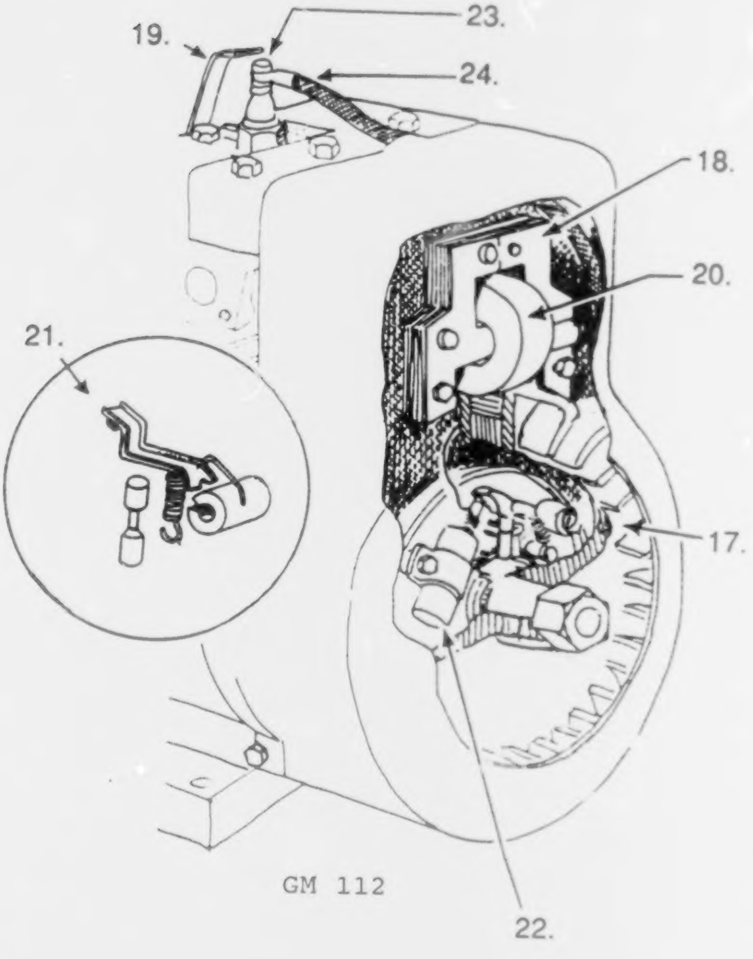
_____20.

_____21.

_____22.

_____23.

_____24.



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Part 4. From the list below, identify the components of a solid state ignition system.

A. Low voltage wire
B. Flywheel with magnets
C. Ignition coil
D. Trigger coil
E. Diode rectifier
AB. Resistor
AC. Transistorized rectifier (solid state switch)

______25.

______26.

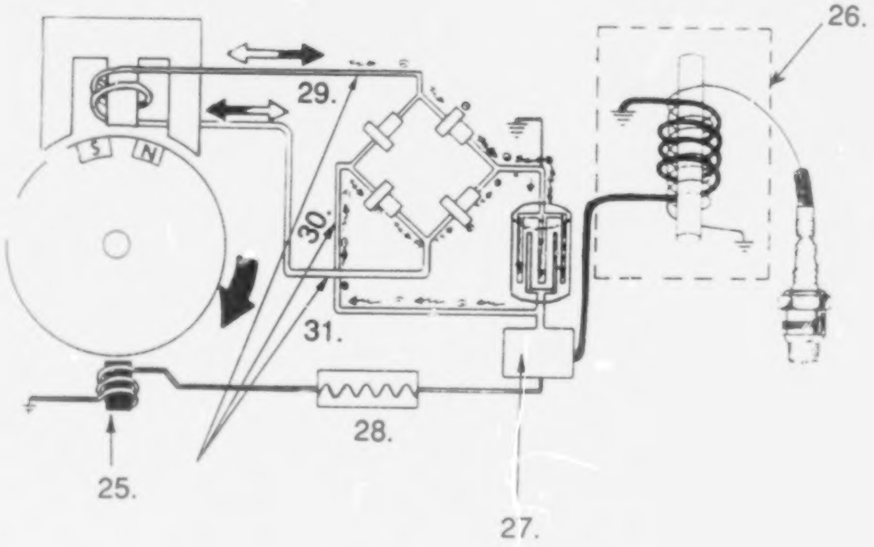
______27.

______28.

______29.

______30.

______31.



Part 5. From the list below, identify components of a breakerless ignition system.

A. Battery
B. Low voltage wire
C. Flywheel
D. Rectifier-regulator
E. Trigger module
AB. Ignition coil assembly
AC. Ignition switch
AD. Alternator-stator

______32.

______33.

______34.

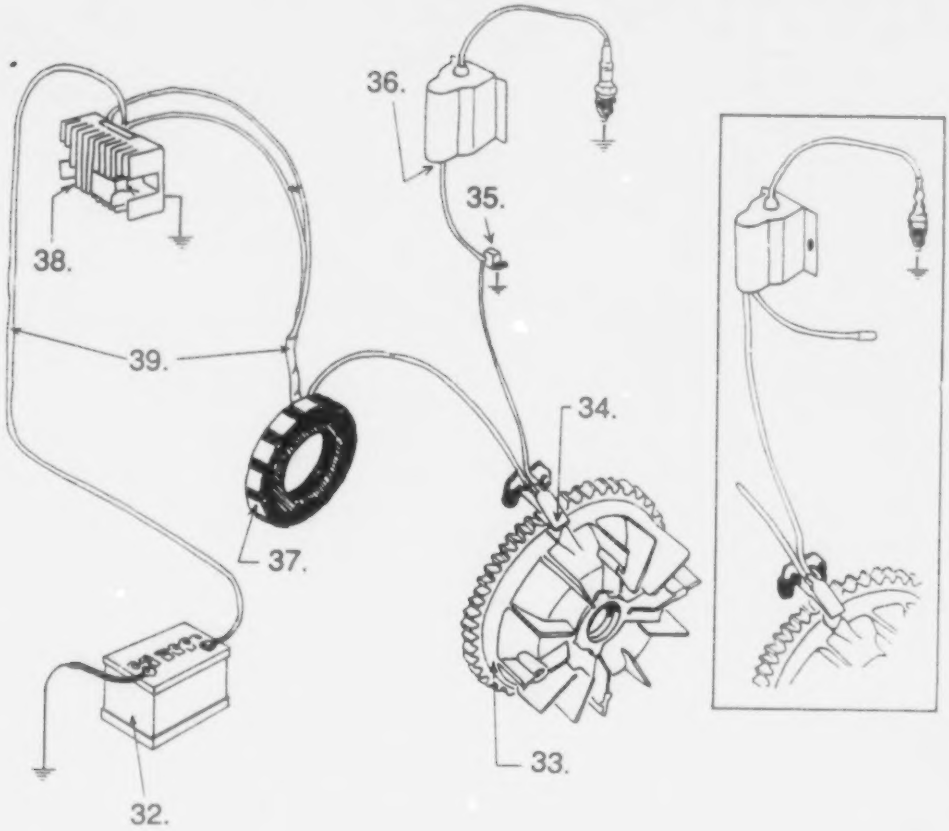
______35.

______36.

______37.

______38.

______39.



Part 6. Match the components of the ignition system below with their correct purposes.

A. Trigger coil
B. Spark plug
C. Coil
D. Resistor
E. High voltage wire
AB. Breaker cam
AC. Battery
AD. Diode rectifier
AE. Contact points
BC. Low voltage wire
BD. Ignition switch
BE. Capacitor
CD. Condenser

______40. Source of electrical power

______41. Opens and closes the primary circuit from the battery or coil to the contact points

______42. Transforms low voltage into high voltage necessary to jump the spark plug gap

______43. Make and break the primary circuit to allow the coil to produce high voltage at the spark plug

______44. Stores extra current as the contact points open to prevent arcing and burning

______45. Opens the contact points

______46. Changes alternating (AC) current to direct (DC) current

______47. Used in solid state ignition systems and operates like the condenser

______48. Generates a small amount of current that is used to activate the current from the capacitor

______49. Reduces voltage in the primary circuit to protect the contact points

______50. Provides a spark gap inside the engine cylinder to ignite the fuel-air mixture

______51. Carries low voltage from the battery or armature to the primary side of the ignition coil

______52. Carries high voltage from the secondary side of the coil to the spark plug

Part 7. Distinguish among the operational steps of the ignition systems by placing an "X" under the appropriate system heading.

	Battery	Magneto	Solid State	
53.	________	________	________	With the ignition switch on and the contact points closed, low voltage current flows from the battery through the primary windings of the coil and through the contact points to ground
54.	________	________	________	With the ignition switch on or the contact points closed, low voltage current is induced by magnets through the primary windings of the coil and through the contact points to ground
55.	________	________	________	With the ignition switch on, low voltage current from the flywheel magnet induces alternating current (AC) in charge coil
56.	________	________	________	The flow of low voltage current through the primary windings of the coil causes a magnetic field buildup
57.	________	________	________	The AC current passes through a rectifier and changes to direct current (DC), which travels to the capacitor (condenser) where it is stored
58.	________	________	________	As the contact points open, current attempts to continue to flow across the point surfaces --the condenser attached to the points absorbs this flow of current
59.	________	________	________	The flywheel magnets pass the trigger coil and induce a small electrical charge, which turns on the silicon controlled rectifier (SCR)

60. ________ ________ ________ Stopping the flow of current causes the magnetic field of the coil to collapse across the secondary coil windings, causing a high voltage surge

61. ________ ________ ________ The high voltage surge is directed from the secondary windings of the coil through the distributor cap and rotor and on to the spark plug to ground

62. ________ ________ ________ The high voltage surge is directed from the secondary windings of the coil through the secondary wire on to the spark plug to ground

63. ________ ________ ________ The instantaneous discharge of energy induces a very high density magnetic field around the primary winding of the coil, which cuts the secondary winding and thus creates sufficient energy to fire the spark plug

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

ANSWERS TO UNIT I, LESSON 3 TEST

Part 1.

1. B
2. D
3. C
4. A

Part 2.

5. P
6. P
7. S
8. P
9. S
10. S
11. S
12. P
13. P
14. P
15. P
16. S

Part 3.

17. AD
18. AB
19. D
20. B
21. A
22. C
23. E
24. AC

Part 4.

25. B
26. D
27. AB
28. AC
29. E
30. C
31. A

Part 5.

32. A
33. C
34. E
35. AC
36. AB
37. AD
38. D
39. B

Part 6.

40. AC
41. BD
42. C
43. AE
44. CD
45. AB
46. AD
47. BE
48. A
49. D
50. B
51. BC
52. E

Part 7.

53. Battery
54. Magneto
55. Solid state
56. Battery, Magneto
57. Solid state
58. Battery, Magneto
59. Solid state
60. Battery, Magneto
61. Battery
62. Magneto
63. Solid state

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 4: BASIC MAINTENANCE

LESSON OBJECTIVE

After completion of this lesson, the student will be able to IDENTIFY COMMON TYPES OF OUTDOOR POWER EQUIPMENT AND ATTACHMENTS AND PERFORM BASIC EQUIPMENT MAINTENANCE PROCEDURES. Mastery will be evidenced by completion of job sheets and by scoring _____ percent on the lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match terms related to outdoor power equipment repair with the correct definitions.
2. Identify common types of outdoor power equipment.
3. List basic equipment maintenance procedures for outdoor power equipment.
4. List common battery functions.
5. Sharpen a rotary mower blade.
6. Clean and service a battery.
7. Measure battery charge with a hydrometer.
8. Test charge a battery for three minutes.
9. Adjust V-belt tension.
10. Lubricate and adjust spindle assemblies.

Completion of the requirements of this lesson fulfills competencies I-4, I-9, I-10, I-11, and I-12 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 4: BASIC MAINTENANCE

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Job sheets
   1. Sharpen a rotary mower blade
   2. Clean and service a battery
   3. Measure battery charge with a hydrometer
   4. Test charge a battery for three minutes
   5. Adjust V-belt tension
   6. Lubricate and adjust spindle assemblies

D. Lesson test

E. Answers to lesson test

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 4: BASIC MAINTENANCE

INFORMATION OUTLINE

I. Terms and definitions

A. Accessory--equipment designed as an optional component part

B. Battery--two or more connected cells that convert chemical energy into electrical energy

C. Blade balancer--equipment designed to detect an uneven distribution of weight from the center mounting hole to blade tips

D. Cell--one negative and one positive plate group

E. Electrolyte--solution of water and sulfuric acid

F. Hydrometer--glass barrel syringe containing a calibrated float used to measure charge level in battery

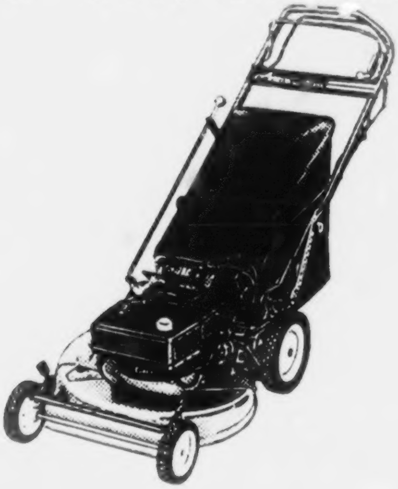
G. Maintenance--routine service procedures necessary to keep equipment operating safely and efficiently

H. Outdoor power equipment--all equipment designed to maintain a lawn or garden

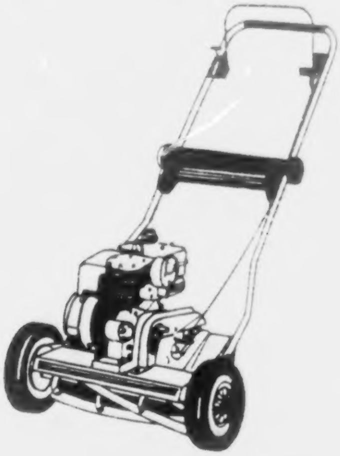
I. Pneumatic--relating to air or air pressure

II. Types of outdoor power equipment

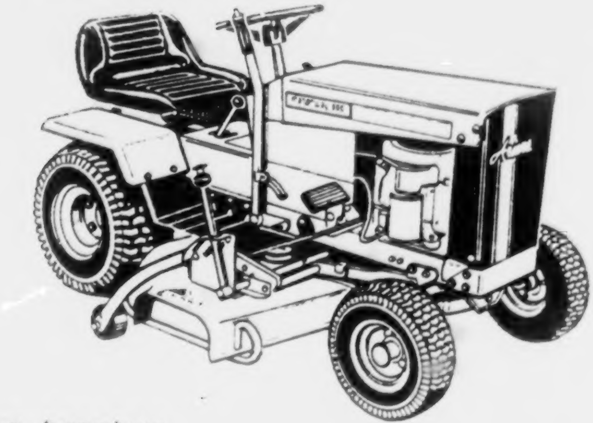
A. Rotary walk-behind mower



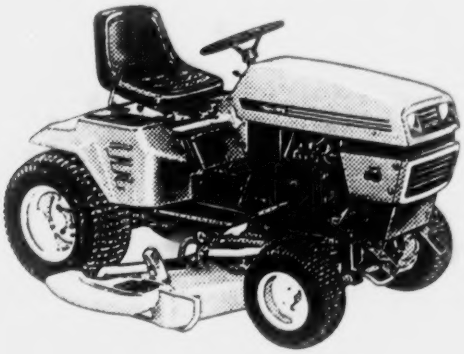
B. Reel mower



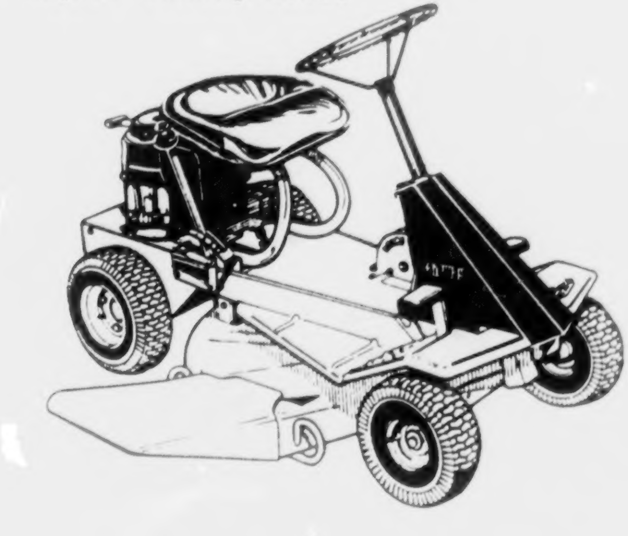
C. Lawn tractor



D. Garden tractor

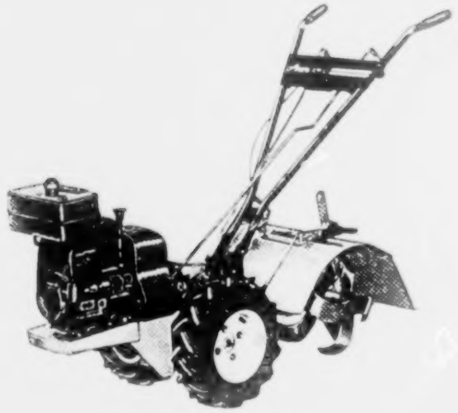


E. Rear engine riding mower

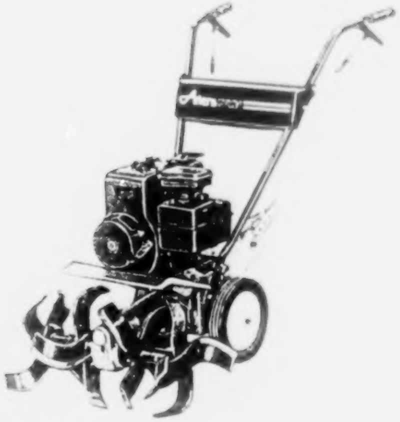


F. Tillers

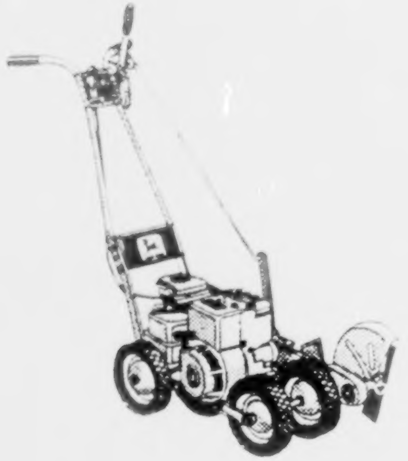
1. Rear tine



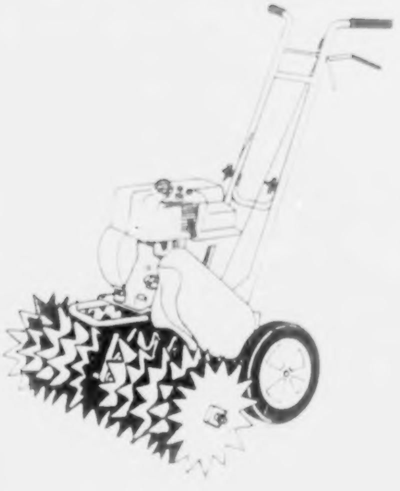
2. Front tine



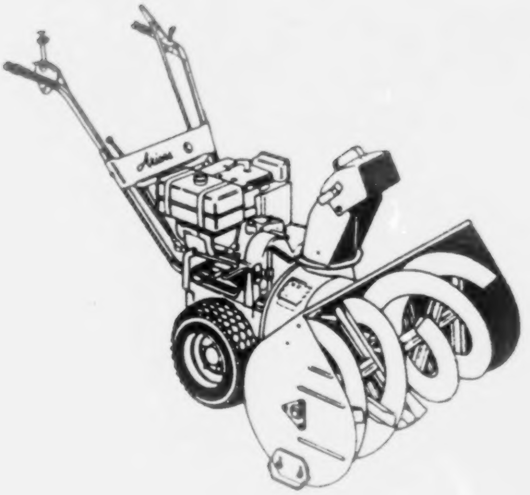
G. Edger



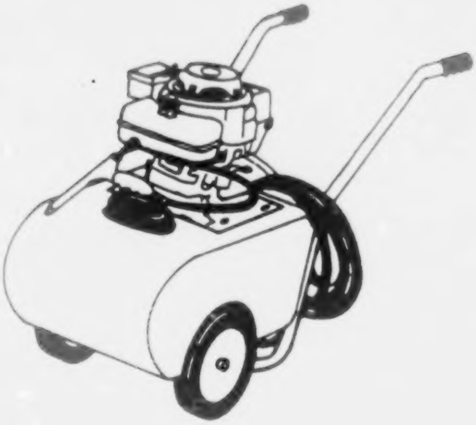
H. Aerator



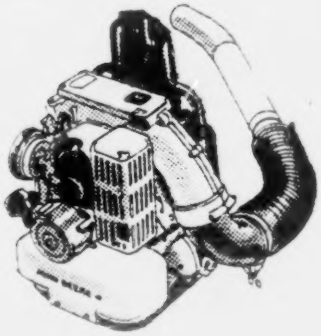
I. Snowthrower



J. Sprayer



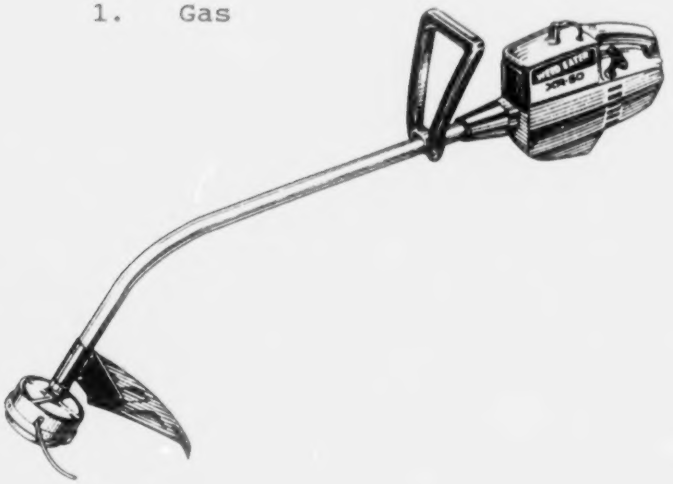
K. Blower



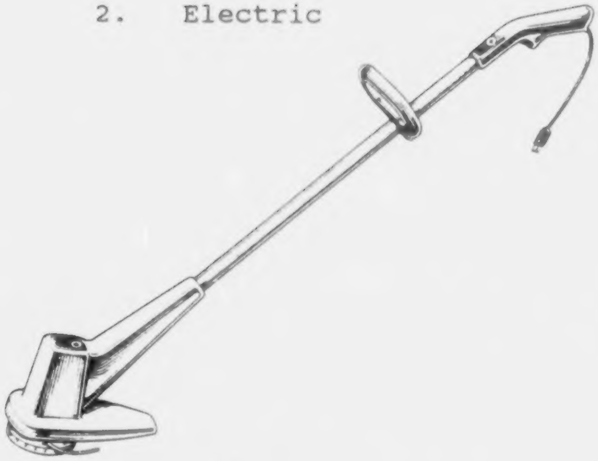
L. Line trimmers

(Note: Brush cutters are similar to these except that they are equipped with a blade instead of nylon line)

1. Gas

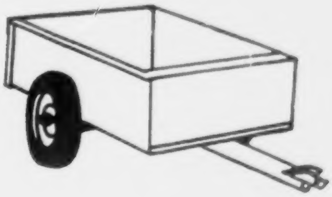


2. Electric

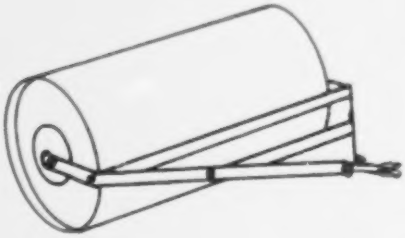


M. Pull-type attachments

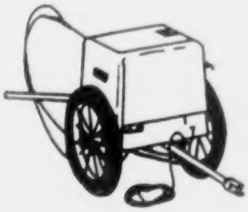
1. Trailers/utility cart



2. Lawn roller/packer

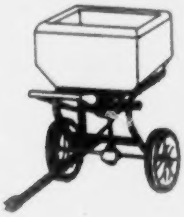


3. Sprayer

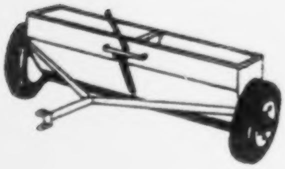


4. Fertilizer/seeder

a. Broadcast



b. Drop



III. Basic equipment maintenance procedures for outdoor power equipment

  A. Keep all belts properly adjusted and clean

  B. Maintain proper tension on chains

  C. Lubricate moving parts according to manufacturer's specifications

     (Example: bearings, chains, gears)

  D. Service engines according to manufacturer's specifications

  E. Keep all blades balanced and cutting edges sharp

  F. Maintain proper inflation on all pneumatic tires

     (Note: Most inflatable outdoor power equipment tires use a relatively low pressure--be sure and check rating before inflating)

  G. Service batteries according to manufacturer's specifications

IV. Battery functions

  A. To supply current for cranking engine

  B. To provide current to meet demands above charging output

  C. To stabilize system voltage

V. Functions of lubricants

  A. To reduce friction and wear in moving parts

  B. To protect parts from rust and corrosion

  C. To help clean and cool moving parts

SHARPEN A ROTARY MOWER BLADE

Equipment:

Safety glasses
Hand tool assortment
Blade balancer
Framing square
Shop towels
Grinder
Face shield

Procedure: Evaluation 3 2 1 N

(CAUTION: Be sure to remove spark plug wire from plug and ground it to the block before removing blade.)

1. Gather tools and equipment. ___ ___ ___ ___

2. Remove blade from mower. ___ ___ ___

(Note: Be sure to place all spacers and washers together in the order of removal for ease in reassembly.)

3. Clean blade. ___ ___ ___ ___

(Note: Remove any built-up grease or clippings that will affect the balancing to be done later.)

4. Check for cracks or chips. ___ ___ ___ ___

(Note: If blade has cracks or large pieces chipped off, replace with new blade.)

5. Sharpen blade with approved blade grinder. ___ ___ ___ ___

(CAUTION: Put on face shield. Put all grinder guards and shields in the correct location.)

6. Dress grinder wheel. ___ ___ ___ ___

7. Adjust tool rest to deliver correct contour of sharpened portion of blade. ___ ___ ___ ___

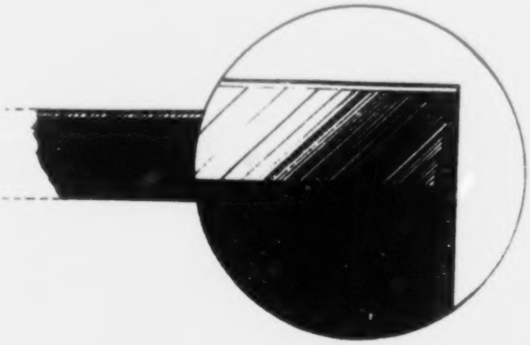
(Note: This is normally 45°.)

8. Turn on grinder.

9. Place blade on tool rest with wheel turning INTO the cutting edge.

(Note: Do not push hard on blade. Keep a bucket of water handy to keep blade cool while sharpening.)

10. Continue until small blunt edge is left.

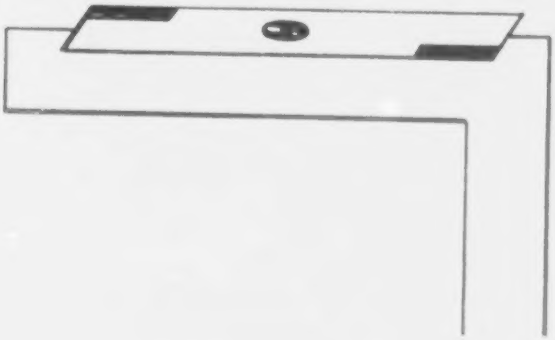


11. Sharpen other cutting edge.

12. Turn off grinder.

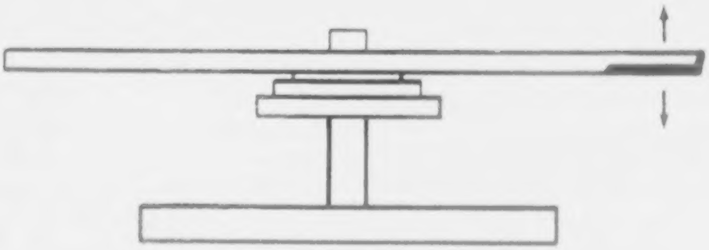
13. Check blade for straightness. Place blade edge of framing square.

(Note: There are magnetic holders and gauges designed for this job. However, you can use a framing square as described.)



14. Check between blade and edge of square for warpage.

15. Check blade balance. Place blade on balancer. ___ ___ ___



16. File cutting edge on lowest end of blade until blade sits level. ___ ___ ___ ___

(Note: Be sure and maintain small blunt edge.)

17. Have instructor evaluate work.

18. Replace blade on mower. ___ ___ ___ ___

19. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ___ ___ ___ ___

Average of above evaluations* ___ ___ ___ ___

*This average is the student's partial evaluation for competency I-4 of Building Maintenance.

CLEAN AND SERVICE A BATTERY

Equipment:

Safety glasses
Rubber gloves
Rubber apron
Bristle brush
Wire brush
Screwdriver
Shop towels

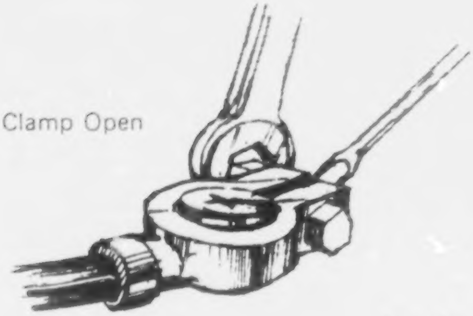
Battery clamp puller
Combination end wrenches
Battery pliers
Baking soda and water solution
(2 tablespoons baking soda to
1 pint water)
Battery anticorrosion paste or spray

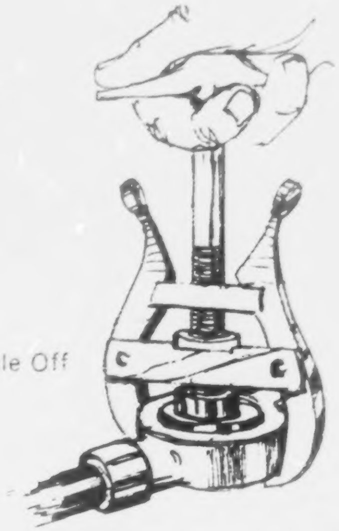
Procedure:

Evaluation
3 2 1 N

1. Disconnect battery cables from the battery posts. ___ ___ ___ ___

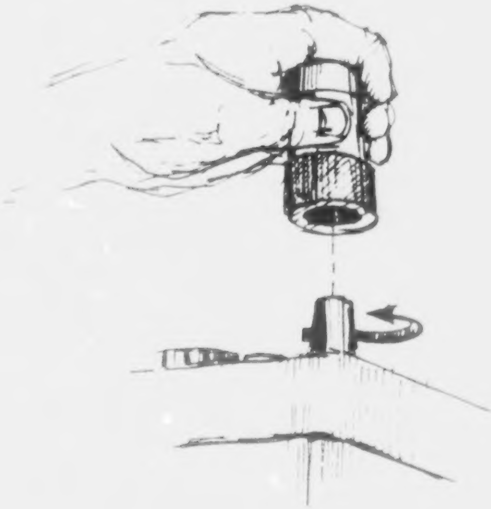
(Note: Always disconnect the grounded battery cable first to avoid short circuits.)

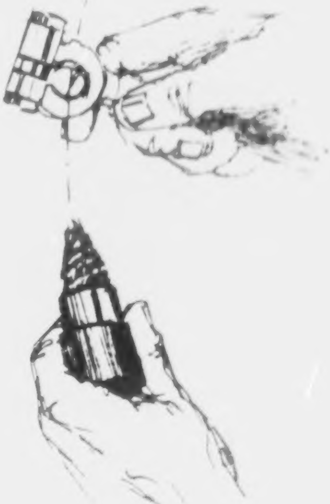




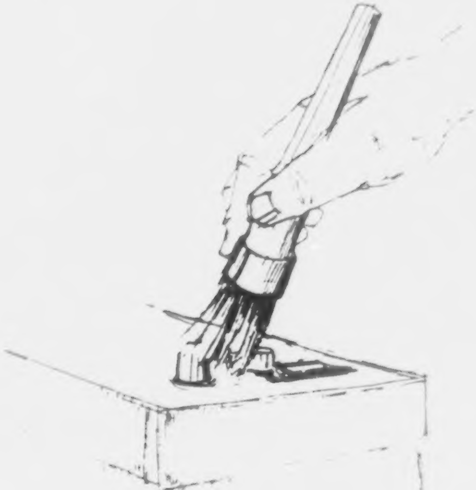
2. Clean battery cable clamps and battery post. _ _ _ _

(Note: Battery posts and inside of battery cable clamps must be clean and bright.)



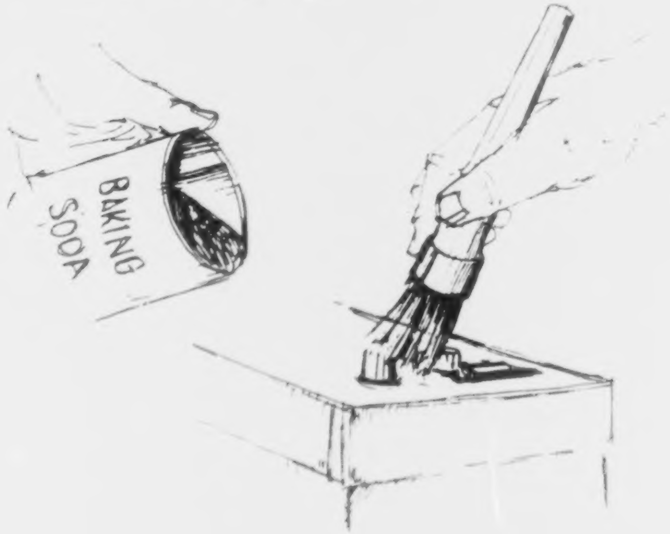


3. Remove loose dirt and corrosion particles from top of battery. _ _ _ _



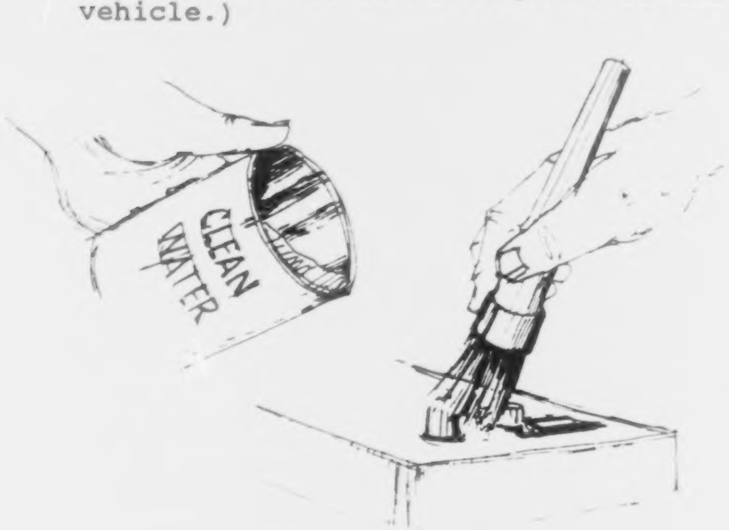
4. Brush soda-water solution on battery, battery post, clamps, and battery hold-down. — — — —

(Note: Keep water and soda from entering the the battery through the vent holes in the vent caps.)



5. Wash away residue with clean water. — — — —

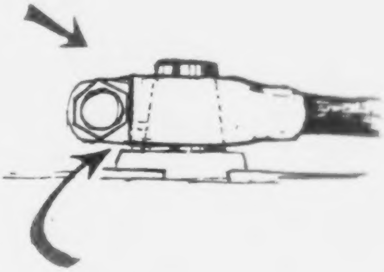
(Note: Remove all residue that may have lodged around battery, frame or parts of the vehicle.)



6. Dry the battery and battery cables with a clean cloth. ___ ___ ___ ___

7. Reconnect battery cables to the battery posts. ___ ___ ___ ___

   (CAUTION: Always reconnect the positive (+) first and the ground cable last.)



8. Spread a coating of battery anti-corrosion paste over the cable clamps and terminals. ___ ___ ___ ___

9. Remove vent caps and check electrolyte level in all cells. ___ ___ ___ ___

10. Add water if necessary to bring electrolyte up to proper level. ___ ___ ___ ___

    (Note: Do not overfill.)

11. Have instructor evaluate work. ___ ___ ___ ___

12. As directed by instructor, prepare for next job sheet of clean up area and return tools and materials. ___ ___ ___ ___

Average of above evaluations* ___ ___ ___ ___

*This average is the student's partial evaluation for competency I-10 of Building Maintenance.

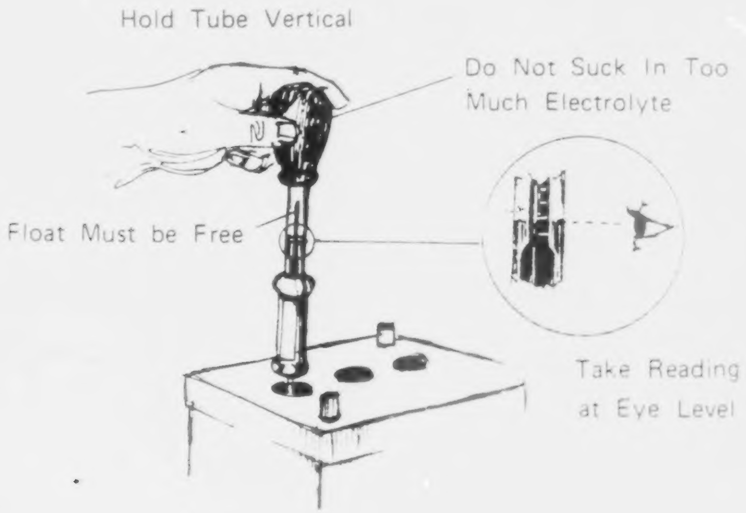
MEASURE BATTERY CHARGE WITH A HYDROMETER

Equipment:

Hydrometer
Shop towels
Container of clean water
Safety glasses
Rubber gloves
Rubber apron

Procedure:

	Evaluation 3	2	1	N
1. Remove vent caps from battery.	__	__	__	__
2. Insert the hydrometer into the first cell.	__	__	__	__
3. Squeeze the rubber bulb to draw electrolyte into the hydrometer to suspend the float.	__	__	__	__
(Note: If the electrolyte level is too low, add water, charge until battery reaches capacity, and recheck.)				
4. Take reading at eye level.	__	__	__	__
(Note: Make sure the float is not bumping the top of the hydrometer tube or sticking to the side of the tube. Write down reading for each cell.)				


Hold Tube Vertical
Do Not Suck In Too Much Electrolyte
Float Must be Free
Take Reading at Eye Level

GM 141

14. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ___ ___ ___ ___

Average of above evaluations* ___ ___ ___ ___

*This average is the student's partial evaluation for competency I-10 of Building Maintenance.

JS 4

TEST CHARGE A BATTERY FOR THREE MINUTES

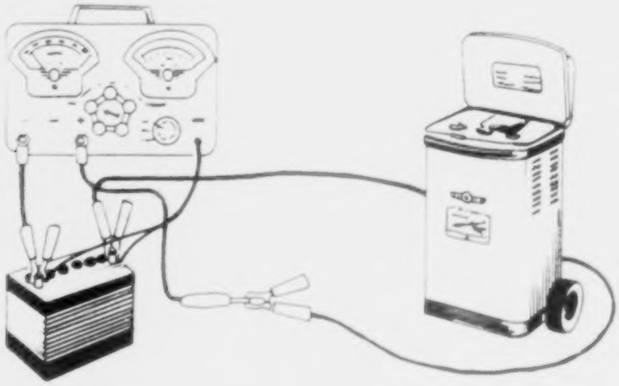
Equipment:

- Adjustable, fast-rate battery charger
- Battery capacitor tester
- Appropriate conductors
- Safety glasses
- Rubber gloves
- Rubber apron

Procedure:

Evaluation
3 2 1 N

1. Connect tester and charger. __ __ __ __



2. Turn charger on and adjust the charging rate to 40 amps. __ __ __ __

3. Charge battery for 3 minutes. __ __ __ __

4. Read individual cell voltages with battery charger still in operation. __ __ __ __

(Note: If they vary by more than 0.1 volt, replace the battery.)

5. Read total battery voltage. ___ ___ ___ ___

(Note: If it is over 15.5v, the battery is unsatisfactory and must be given a long, slow charge and load tested again. If voltage under load test is less than 9v, replace battery.)

6. Have instructor evaluate work. ___ ___ ___ ___

7. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ___ ___ ___ ___

Average of above evaluation* ___ ___ ___ ___

*This average is the student's partial evaluation for competency I-10 of Building Maintenance.

JS 5

ADJUST V-BELT TENSION

Equipment:

Safety glasses
Hand tool assortment
Straight edge
Belt-drive equipment
Appropriate equipment service manual

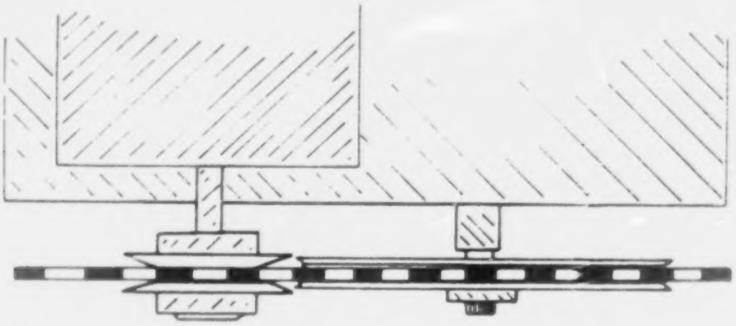
Procedure:

Evaluation
3 2 1 N

1. Put on safety glasses and disconnect the spark plug lead and ground it to the block. ___ ___ ___ ___

2. Remove V-belt. ___ ___ ___ ___

3. Check pulley alignment. ___ ___ ___ ___

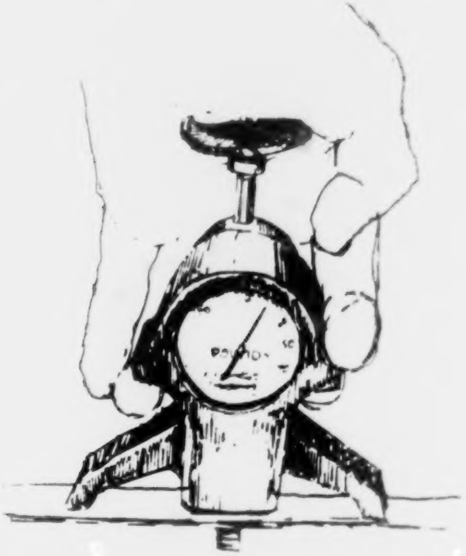


4. **Place a straight edge** in the pulley groves to check alignment. ___ ___ ___ ___

   (Note: If pulleys do not align, loosen set screws and align them.)

5. Replace belt. ___ ___ ___ ___

6. Check belt tension with a belt tension gauge and adjust to manufacturer's specifications. ___ ___ ___ ___



7. Have instructor evaluate work. ___ ___ ___ ___

8. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ___ ___ ___ ___

Average of above evaluations* ___ ___ ___ ___

*This average is the student's partial evaluation for competency I-9 of Building Maintenance.

JS 6

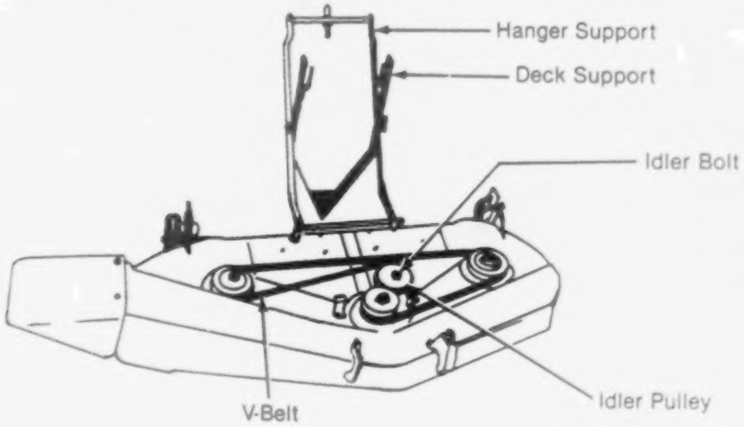
LUBRICATE AND ADJUST SPINDLE ASSEMBLIES

Equipment

Pressure-type grease gun
No. 2 wheel bearing grease
Mechanics tool box
Rubber mallet

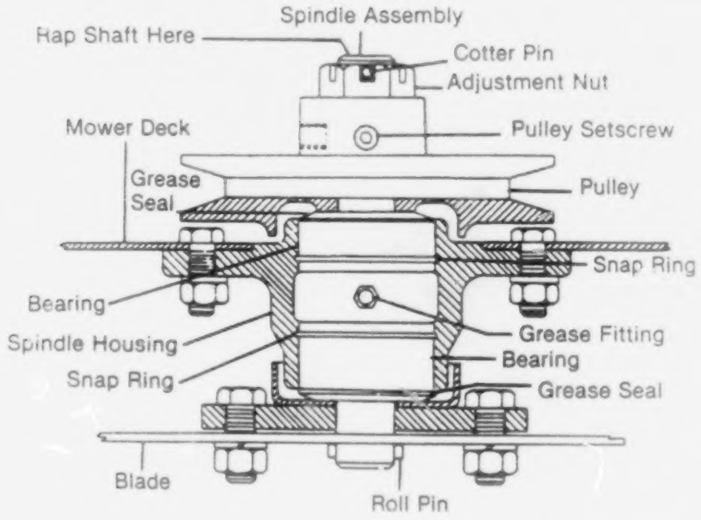
Procedure:

	Evaluation			
	3	2	1	N
1. Remove mower from tractor.	___	___	___	___
2. Pull deck support and pivot hanger support back and free of cover.	___	___	___	___


Hanger Support
Deck Support
Idler Bolt
Idler Pulley
V-Belt

3. Remove belt covers.	___	___	___	___

4. Remove cotter pin.


Spindle Assembly
Rap Shaft Here
Cotter Pin
Adjustment Nut
Mower Deck
Pulley Setscrew
Grease Seal
Pulley
Snap Ring
Bearing
Grease Fitting
Spindle Housing
Bearing
Snap Ring
Grease Seal
Blade
Roll Pin

5. Loosen pulley set screws.

6. Tighten adjustment nut (clockwise) until all play is removed.

7. Back nut off one notch on spindle (1/16 of a turn counterclockwise.)

8. Secure with cotter pin.

9. Rap end with shaft sharply with a rubber mallet.

10. Lock set screws in pulley.

11. Check adjustments.

(Note: Shaft should have no noticeable endplay and still turn freely.)

12. Replace covers and support assembly.

13. Lubricate with grease gun. ___ ___ ___ ___

14. Have instructor evaluate work. ___ ___ ___ ___

15. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ___ ___ ___ ___

Average of above evaluations*

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*This average is the student's partial evaluation for competency I-4 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 4: BASIC MAINTENANCE

LESSON TEST

Part 1. Match the terms below with the correct definitions.

A. Accessory
B. Battery
C. Blade balancer
D. Cell
E. Electrolyte
AB. Hydrometer
AC. Maintenance
AD. Outdoor power equipment
AE. Pneumatic

_____ 1. Routine service procedures necessary to keep equipment operating safely and efficiently

_____ 2. Solution of water and sulfuric acid

_____ 3. Relating to air or air pressure

_____ 4. Equipment designed as an optional component part

_____ 5. One negative and one positive plate group

_____ 6. All equipment designed to maintain a lawn or garden

_____ 7. Equipment designed to detect an uneven distribution of weight from the center mounting hole to blade tips

_____ 8. Glass barrel syringe containing a calibrated float used to measure charge level in battery

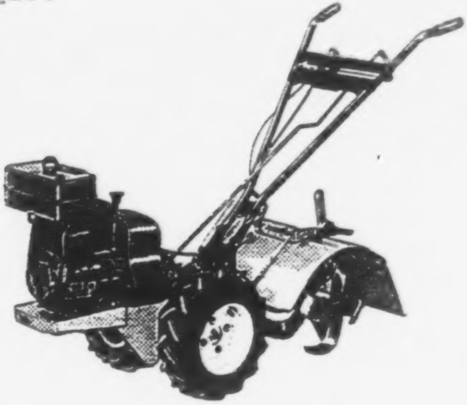
_____ 9. Two or more connected cells that convert chemical energy into electrical energy

Part 2. Identify the following outdoor power equipment by matching a letter from the list below with the correct picture.

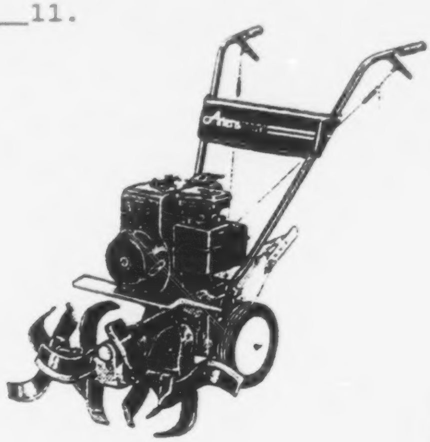
A. Rear mount riding mower
B. Reel mower
C. Garden tractor
D. Rear tine tiller
E. Rotary walk-behind mower
AB. Front tine tiller
AC. Lawn tractor

AD. Sprayer
AE. Aerator
BC. Electric line trimmer
BD. Gas line trimmer
BE. Edger
CD. Blower
CE. Snowthrower

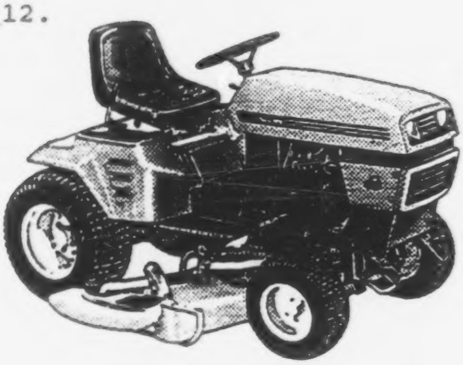
_____10.



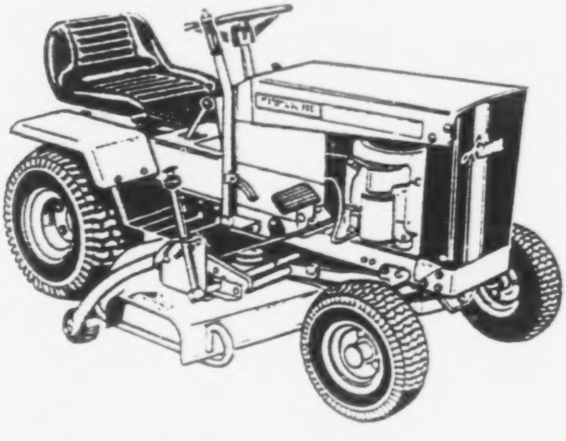
_____11.



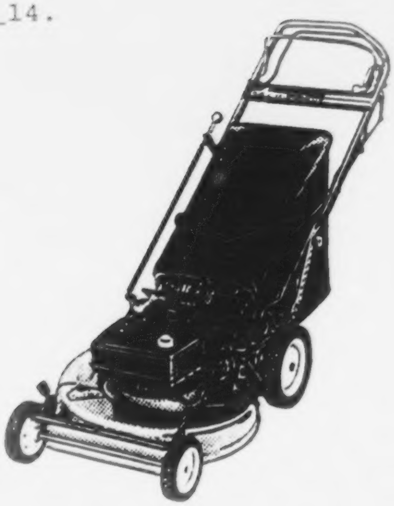
_____12.



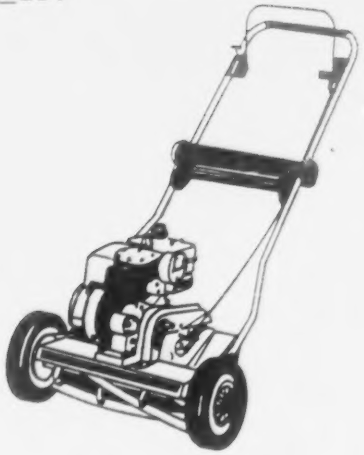
_____13.



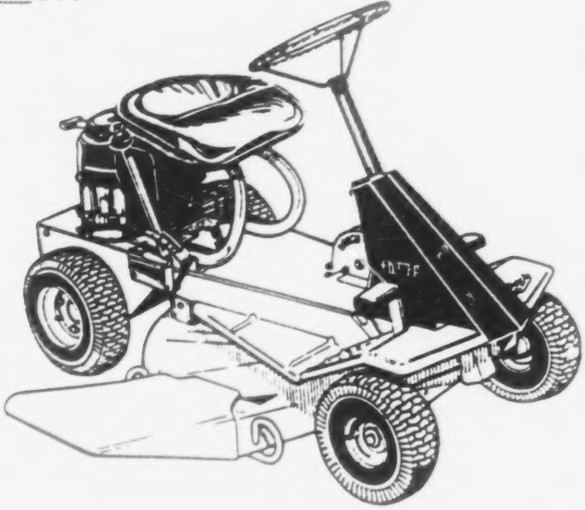
______14.



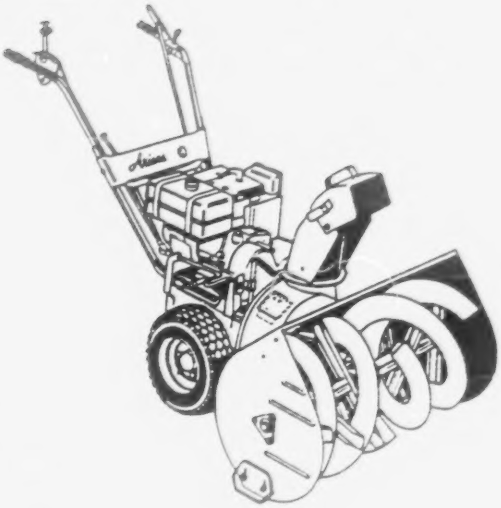
______15.



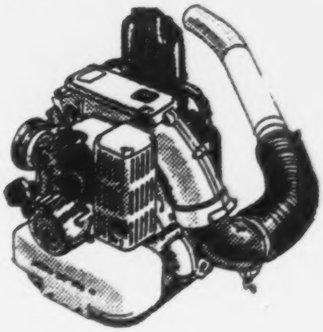
______16.



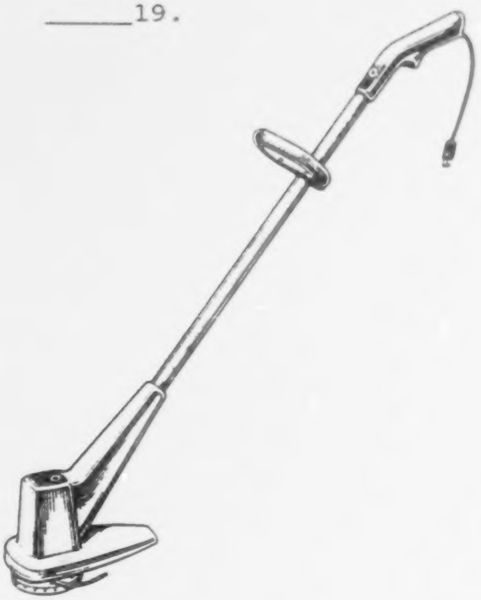
______17.



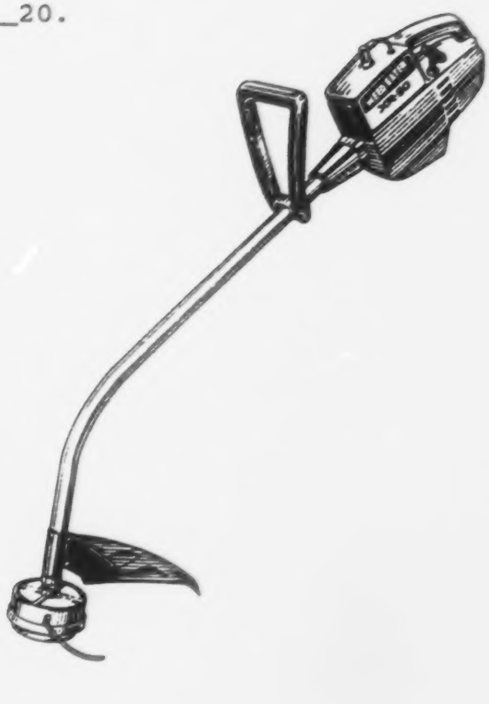
_____18.



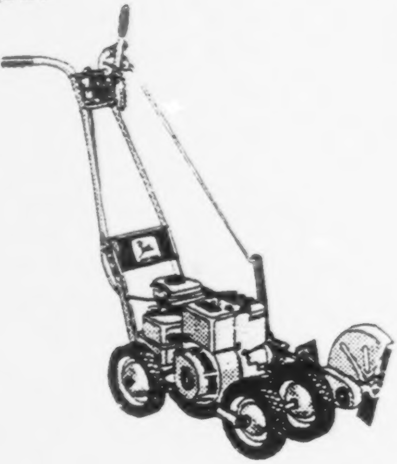
_____19.



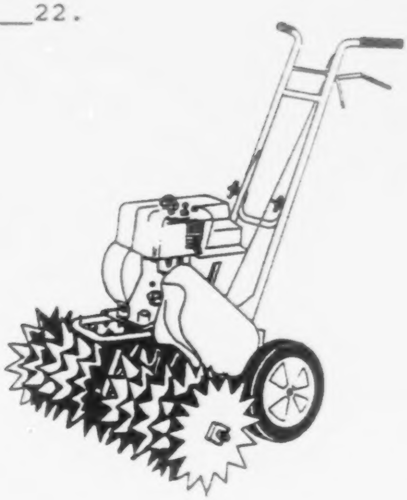
_____20.


WEED EATER
XR-90

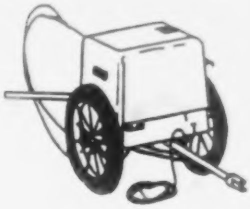
_____21.



_____22.



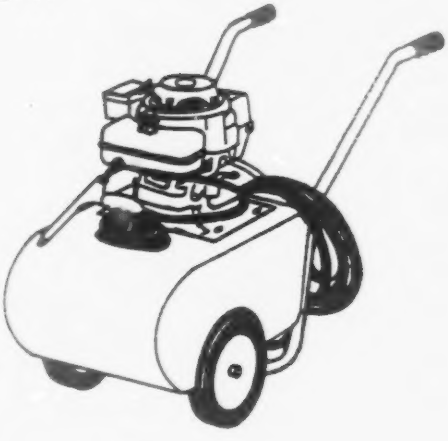
_____23.



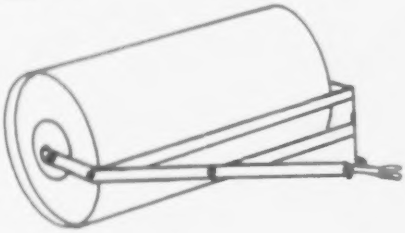
Part 3. Identify the following outdoor power equipment attachments by matching the letters from the list below with the correct picture.

A. Sprayer
B. Lawn roller/packer
C. Trailer/utility cart
D. Drop fertilizer/seeder

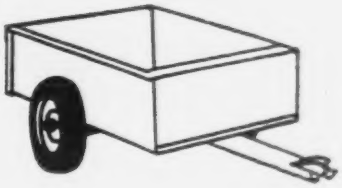
_____24.



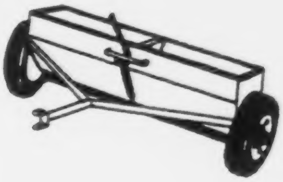
_____25.



_____26.



_____27.



Part 4. Choose the correct statements concerning basic equipment maintenance procedures by marking an (X) on the blanks.

_____28. Keep all belts properly adjusted and wiped with oil

_____29. Lubricate moving parts according to manufacturer's specifications

_____30. Service engines according to manufacturer's specifications

_____31. Sharpen and balance blades once each year

Part 5. Select from the following list the functions of lubricants by placing an (X) in the appropriate blanks.

_____32. To help clean and cool moving parts

_____33. To help keep the engine charged

_____34. To supply additives and boosters to fuel system

_____35. To reduce friction and wear in moving parts

_____36. To protect parts from rust and corrosion

Part 6. List two common battery functions.

____

____

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

ANSWERS TO UNIT I, LESSON 4 TEST

Part 1.

1. AC
2. E
3. AE
4. A
5. D
6. AD
7. C
8. AB
9. B

Part 2.

10. D
11. AB
12. C
13. AC
14. E
15. B
16. A
17. CE
18. CD
19. BC
20. BD
21. BE
22. AE
23. AD

Part 3.

24. A
25. B
26. C
27. D

Part 4.

28.
29. X
30. X
31.

Part 5.

32. X
33.
34.
35. X
36. X

Part 6.

Any two of the following:

To supply current for cranking engine
To provide current to meet demands above charging output
To stabilize system voltage

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 5: FUELS

LESSON OBJECTIVE

After completion of this lesson, the student will be able to SELECT, MIX AND ADD FUEL TO POWER EQUIPMENT USING 2-CYCLE AND 4-CYCLE ENGINES. Mastery will be evidenced by completion of job sheets and by scoring __________ percent on the lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match terms related to 2-cycle and 4-cycle engine fuels with their definitions.
2. Identify 4-cycle engine operation.
3. Identify 2-cycle engine operation.
4. Select four safety rules in handling gasoline.
5. Mix fuel and oil for 2-cycle engine.
6. Add fuel to fuel tank.

Completion of the requirements of this lesson fulfills competency I-5 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 5: FUELS

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
   1. Operation of the two-stroke cycle engine
   2. Use care with gasoline

D. Job sheets
   1. Preparing fuel for 2-cycle engines
   2. Filling the fuel tank

E. Lesson test

F. Answers to lesson test

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 5: FUELS

INFORMATION OUTLINE

I. Terms and definitions (TM 1)

   A. Intake stroke--downward movement of piston that permits fuel-air mixture to enter cylinder; opens intake valve

   B. Compression stroke--upward movement of piston that compresses fuel-air mixture; intake and exhaust valves closed

   C. Power stroke--downward piston movement caused by spark ignition of compressed fuel-air mixture; intake and exhaust valves closed

   D. Exhaust stroke--upward piston movement that expels burnt gases from cylinder; exhaust valve opens

   E. Regular gasoline--fuel used in 4-cycle engines

   F. Gasoline/oil mix--fuel used in 2-cycle engine

   G. 2-cycle oil--oil mixed with gasoline for use in 2-cycle engines

   H. Fuel/oil ratio--the amount of oil and fuel mixed by volume for use in 2-cycle engines

   I. Octane rating--the anti-knock quality of regular grade gasoline determined by compression ratio of engine

II. Operation of 4-stroke cycle engine

   (Note: Four-stroke refers to the number of times the piston moves up and down in the cylinder to complete one cycle of operation--four-stroke cycle engines are commonly called 4-cycle engines)

   A. Intake stroke
      1. Cycle starts with piston at uppermost position in cylinder (TDC) with intake valve open and exhaust valve closed
      2. As the piston moves down the cylinder, it draws air-fuel mixture into the cylinder from the carburetor

3. When the piston reaches the bottom of the cylinder (BDC), the intake valve closes

B. Compression stroke
   1. Air-fuel mixture is compressed tightly as the piston moves up the cylinder
   2. Compression of the fuel creates heat that prepares the fuel for instant ignition

C. Power stroke
   1. As the piston reaches the top of the cylinder on compression stroke, a spark from the ignition system ignites the air-fuel mixture
   2. Burning gases expand very rapidly and force the piston down the cylinder

D. Exhaust stroke
   1. As the piston reaches the bottom of the cylinder on power stroke, the exhaust valve opens
   2. Piston travels up the cylinder, forcing the burned gases out of the cylinder into the exhaust manifold

   (Note: The complete cycle takes two rotations of the crankshaft or 720° of rotation)

III. Operation of a 2-stroke cycle engine

A. Piston moves up in cylinder drawing fuel-air mixture into crankcase

B. Piston moves down cylinder, pressurizing mixture in crankcase

C. Piston moves past transfer port allowing pressurized mixture to move into combustion chamber

D. Piston moves up in cylinder again
   1. Compresses fuel-air mixture
   2. Draws more fuel-air mixture into crankcase

E. Spark plug fires compressed mixture

F. Combustion moves piston back down cylinder
   1. Piston uncovers exhaust port as it nears bottom of stroke allowing exhaust to escape
   2. Piston uncovers transfer port as it moves nearer bottom of stroke allowing fresh charge of fuel-air to enter combustion chamber

G. Piston starts back up cylinder closing both transfer and exhaust ports

IV. Safety rules for handling gasoline (TM 2)

A. Shut off engine and allow it to cool before adding gasoline

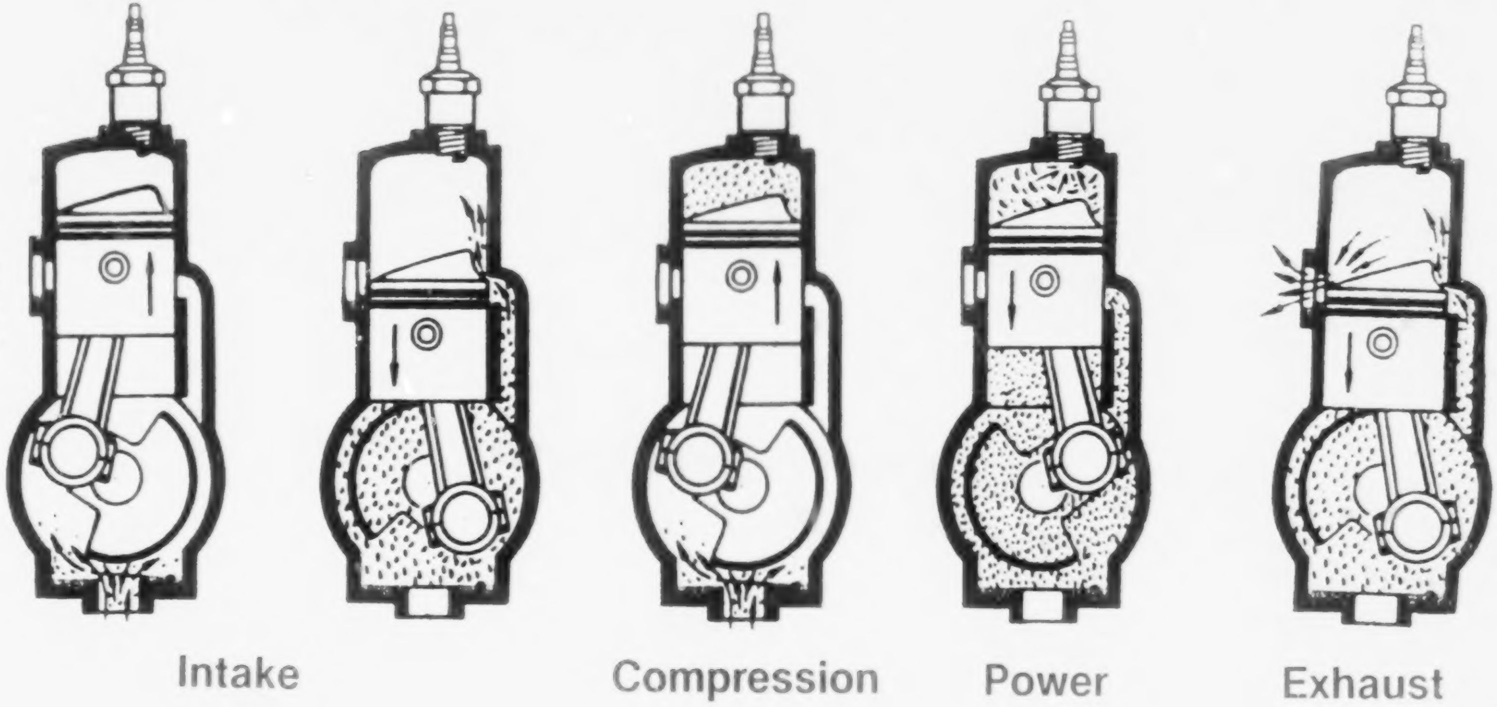
B. Never add fuel to engine near fire or flame

C. Fuel spills should be wiped up or flushed with water immediately

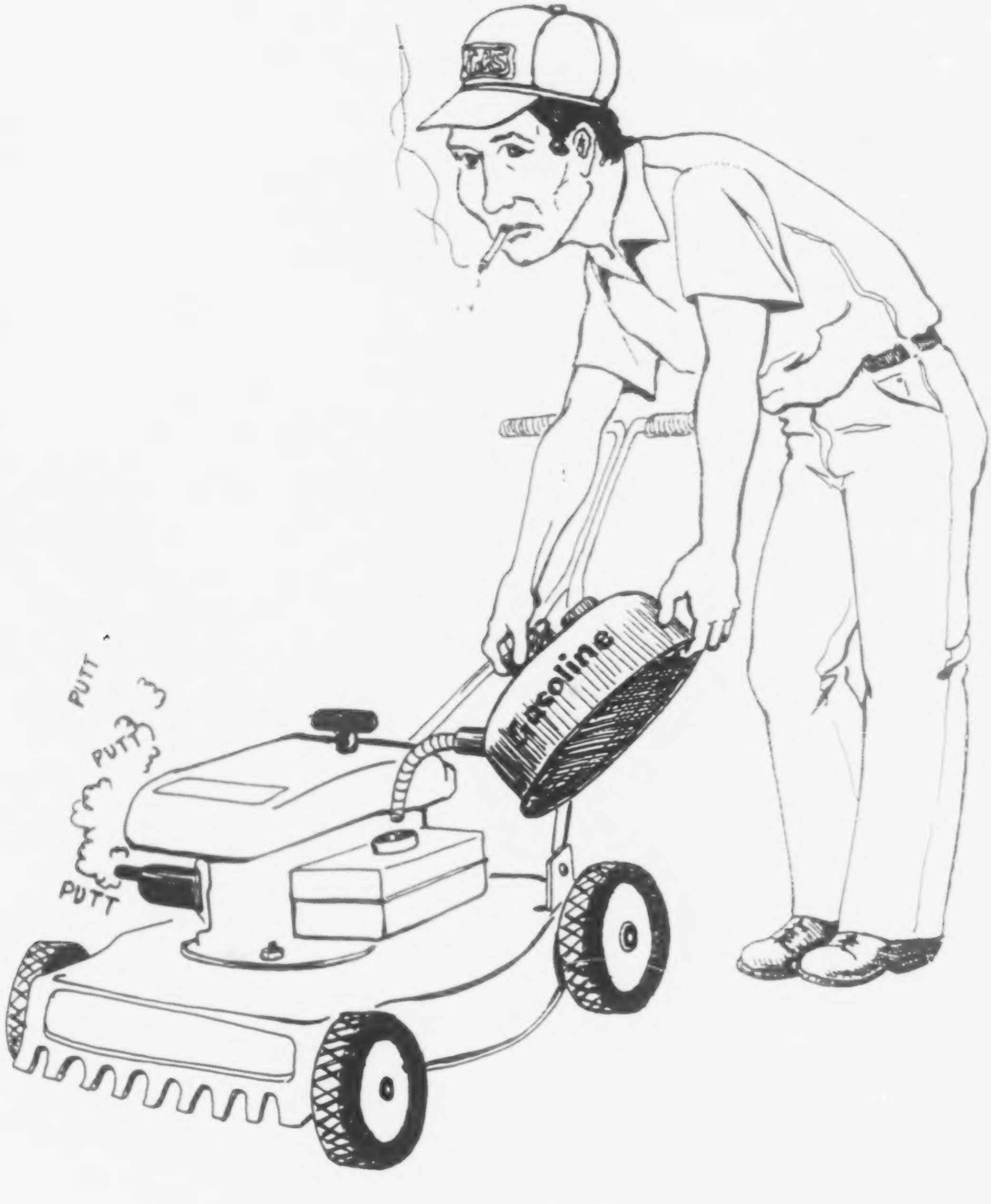
D. Fuel spilled on skin should be washed with soap and water immediately

Operation of the Two-Stroke Cycle Engine

GM 169


Intake
Compression
Power
Exhaust

Use Care With Gasoline


PUTT
PUTT
PUTT
Gasoline

PREPARING FUEL FOR 2-CYCLE ENGINES

Equipment:

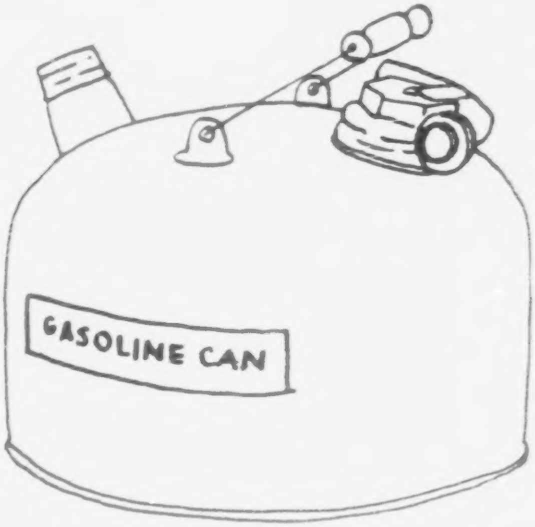
Funnel and strainer
Clean, fresh, regular gasoline
Fire extinguisher
Oil as recommended--for 2-cycle engines most manufacturers recommend SAE 30 or 40 non-detergent (ML) oils. Some recommend multi-viscosity oils. Many manufacturers supply their own brand of oil.)

Procedure:

Evaluation
3 2 1 N

1. Secure an adequate-size enclosed can for mixing. ___ ___ ___ ___

(Note: The container should have twice the capacity of the amount of fuel you intend to mix. Make sure it is clean.)



2. Fill container 1/4 full of fuel. ___ ___ ___ ___

3. Add oil to the gasoline. ___ ___ ___ ___

4. Shake the can vigorously. ___ ___ ___ ___

5. Add more gasoline until container is 1/2 full. ___ ___ ___ ___

6. Shake the can again. ___ ___ ___ ___

7. Keep can tightly closed and well marked when not in use. ___ ___ ___ ___

8. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ___ ___ ___ ___

Average of above evaluations* ___ ___ ___ ___

***This average is the student's partial evaluation for I-5 of Building Maintenance.**

FILLING THE FUEL TANK

Equipment:

Safety glasses
Funnel and strainer
Clean, fresh, regular gasoline
Fire extinguisher

Procedure:

Evaluation
3 2 1 N

1. Stop engine, if it is running. ___ ___ ___ ___

   (Note: Allow engine to cool if it is extremely hot.)

2. Locate the fuel-tank filler cap. ___ ___ ___ ___

   (Note: On some small tractors you will have to raise the hood. Check gasket in tank cap. Replace it if it does not seal.)

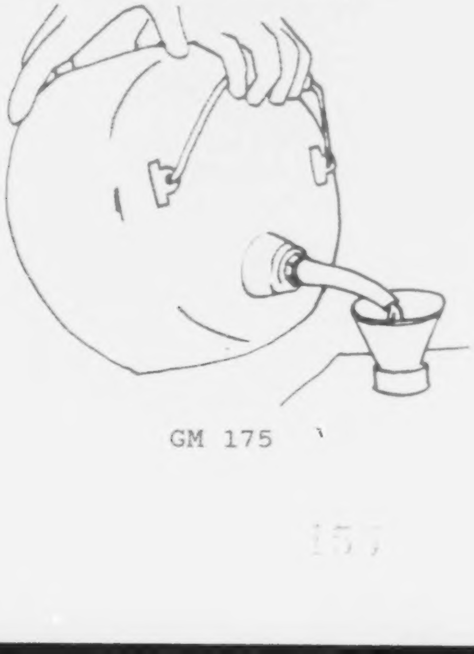
3. Wipe dust and dirt from around the filler cap. ___ ___ ___ ___

4. Remove filler cap. ___ ___ ___ ___

   (CAUTION: Do not smoke or light a match near the open fuel tank. It is an unnecessary fire hazard.)

5. Check visually the fuel level in the tank. ___ ___ ___ ___

   (Note: Never put a dirty stick in your tank to check the fuel level.)



GM 175

6. Refill the tank if necessary. Use a funnel and 120-mesh filter if possible. When pouring fuel, keep the nozzle in contact with the metal fuel tank. Fuel movement can cause static electricity. This contact grounds the electrical charge and avoids any risk of igniting the gasoline vapors. ___ ___ ___ ___

   (Note: Never use the last few drops from a gasoline can. Water and trash are likely to be present. If fuel is accidentally spilled, wipe it away with a rag.)

7. Replace fuel-tank filler cap securely. ___ ___ ___ ___

8. Fasten the hood if it was opened. ___ ___ ___ ___

9. Store remaining gasoline. ___ ___ ___ ___

10. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ___ ___ ___ ___

Average of above evaluations* ___ ___ ___ ___

*This average is the student's partial evaluation for competency I-5 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 5: FUELS

LESSON TEST

Part 1. Match the terms below with the correct definitions.

A. Regular gasoline
B. Power stroke
C. Compression stroke
D. Gasoline/oil mix
E. Fuel/oil ratio
AB. Intake stroke
AC. 2-cycle oil
AD. Octane rating
AE. Exhaust stroke

______ 1. Downward movement of piston that permits fuel-air mixture to enter cylinder

______ 2. Upward movement of piston that compresses fuel-air mixture

______ 3. Downward piston movement caused by spark ignition of compressed fuel-air mixture

______ 4. Upward piston movement that expels burnt gases from cylinder

______ 5. Fuel used in 4-cycle engines

______ 6. Fuel used in 2-cycle engine

______ 7. Oil mixed with gasoline for use in 2-cycle engines

______ 8. The amount of oil and fuel mixed by volume for use in 2-cycle engines

______ 9. Octane rating--the anti-knock quality of regular grade gasoline determined by compression ratio of engine

Part 2. Select true statements concerning the operation of a 4-stroke cycle engine by placing an "X" in the appropriate blanks.

A. Intake stroke

______10. Cycle starts with piston at uppermost position in cylinder (TDC) with intake valve closed and exhaust valve open

_____11. As the piston moves down the cylinder, it draws air-fuel mixture into the cylinder from the carburetor

_____12. When the piston reaches the bottom of the cylinder (BDC), the intake valve closes

B. Compression stroke

_____13. Air-fuel mixture is compressed tightly as the piston moves down the cylinder

_____14. Compression of the fuel creates heat that prepares the fuel for instant ignition

C. Power stroke

_____15. As the piston reaches the top of the cylinder on compression stroke, a spark from the ignition system ignites the air-fuel mixture

_____16. Burning gases expand very rapidly and force the piston down the cylinder

D. Exhaust stroke

_____17. As the piston reaches the top of the cylinder on power stoke, the exhaust valve closes

_____18. Piston travels up the cylinder, forcing the burned gases out of the cylinder into the exhaust manifold

Part 3. Select true statements concerning the operation of a 2-stroke cycle engine by placing an "X" in the appropriate blanks.

_____19. Piston moves down cylinder drawing fuel-air mixture into crankcase

_____20. Piston moves down cylinder, pressurizing mixture in crankcase

_____21. Piston moves past transfer port allowing pressurized mixture to move into crankcase

_____22. Piston moves up in cylinder again and draws more fuel-air mixture into crankcase

_____23. Spark plug fires compressed mixture

_____24. Combustion moves piston back down cylinder

______25. **Piston starts back up cylinder closing transfer port and opening exhaust port**

Part 4. **Select true statements concerning safe handling of gasoline by placing an "X" in the appropriate blank.**

______26. **Make sure engine is shut off and cool before adding fuel**

______27. **Always use a funnel with a 10-mesh filter**

______28. **Wipe up spills immediately or flush with water**

______29. **Wear rubber boots over shoes**

______30. **Store gasoline in a shatter-proof plastic container**

______31. **Wash spilled fuel from skin immediately with soap and water**

______32. **Never add fuel to engine near fire or flame**

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

ANSWERS TO UNIT I, LESSON 5 TEST

Part 1.

1. AB
2. C
3. B
4. AE
5. A
6. D
7. AC
8. E
9. AD

Part 2.

10.
11. X
12.
13.
14. X
15. X
16. X
17.
18. X

Part 3.

19.
20. X
21.
22. X
23. X
24. X
25.

Part 4.

26. X
27.
28. X
29.
30.
31. X
32. X

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 6: AIR FILTER AND COOLING SYSTEMS

LESSON OBJECTIVE

After completion of this lesson, the student will be able to REMOVE, CLEAN AND REPLACE AIR FILTER AND COOLING SYSTEM. Mastery will be evidenced by completion of job sheets and by scoring ____________ percent on the lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match terms related to cooling and air cleaning systems with their correct definitions.
2. Identify components of the cooling system.
3. Match components of the cooling system with their correct functions.
4. Identify three types of air cleaners.
5. Demonstrate the ability to remove, clean and replace air cooling parts.
6. Demonstrate the ability to remove, clean and replace air cleaners.

Completion of the requirements of this lesson fulfills competency I-8 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 6: AIR FILTER AND COOLING SYSTEMS

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
   1. Parts of a cooling system
   2. Types of air cleaners

D. Job sheets
   1. Remove, clean and replace air cooling parts
   2. Service an air cleaner

E. Lesson test

F. Answers to lesson test

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 6: AIR FILTER AND COOLING SYSTEMS

INFORMATION OUTLINE

I. Terms and definitions

- A. Conduction--heat transfer through a solid material
- B. Convection--heat transfer through movement of a gas

  (Note: In cooling systems, transfer is through air)
- C. Shroud--cover over blower (flywheel) that directs air to the engine fins
- D. Baffle--cover over the finned area of the engine to hold the air around the fins
- E. Fin--protrusions cast on the head and cylinder to provide increased surface for additional cooling area
- F. Cooling system--components designed to keep the engine at its most efficient operating temperature during engine operation
- G. Air cleaner--filters grit and dust from the air entering the carburetor

II. Functions of the cooling system

- A. Removes surplus or unwanted heat
- B. Maintains efficient operating temperature under all operating conditions
- C. Brings an engine, when started, up to operating temperature as soon as possible

III. Components of the cooling system (TM 1)

- A. Flywheel
- B. Filter screen
- C. Blower shroud
- D. Cylinder head baffle

E. Cylinder baffle

F. Air deflector

IV. Components of the cooling system and their functions

A. Flywheel--device used to move large volume of air to the engine

B. Filter screen--covering on outside of flywheel to filter out large materials in the air stream

(Note: These are such materials as leaves and grass)

C. Shroud and baffles--covers flywheel and directs air over the engine fins to promote cooling

D. Air deflector--routes the air to cool the engine

V. Types of air cleaners (TM 2)

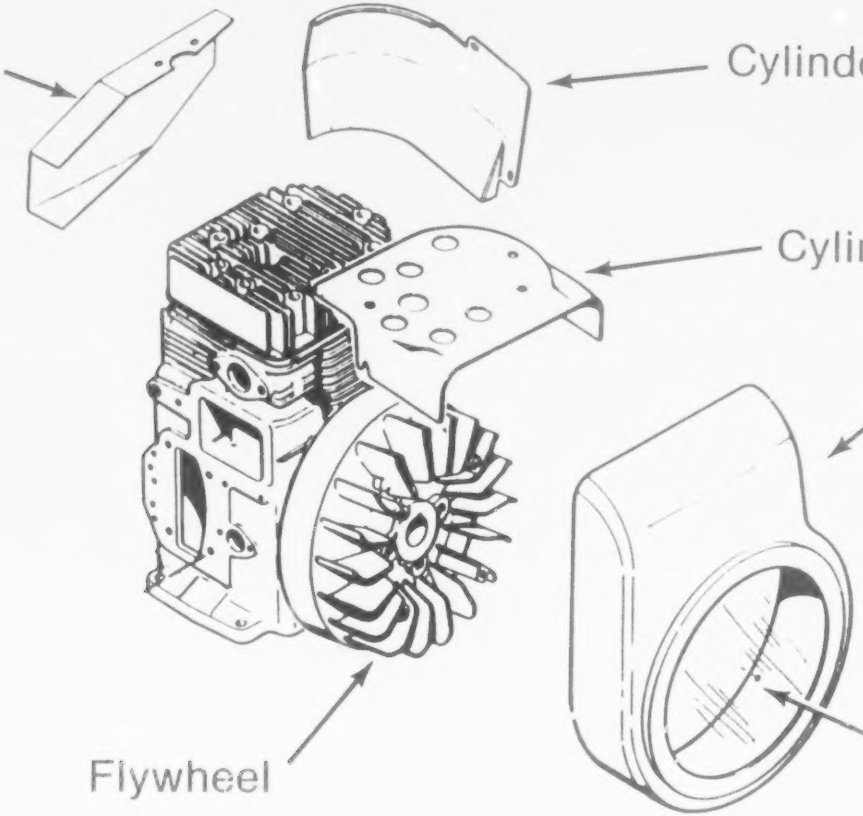
A. Oil bath

B. Paper element

C. Polyurethane

(Note: Some systems use a dual element filter)

Parts of a Cooling System

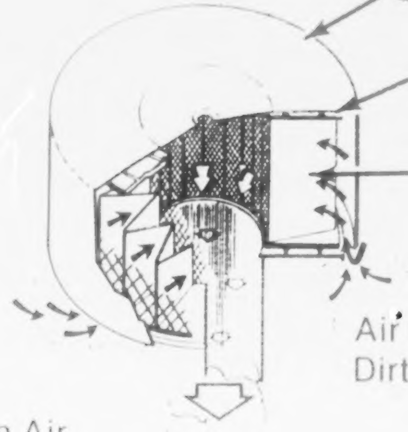

Air Deflector
Cylinder Baffle
Cylinder Head Baffle
Blower Shroud
Filter Screen
Flywheel

GM 189

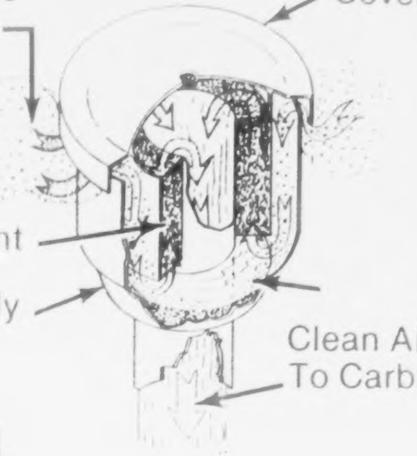
TM 1

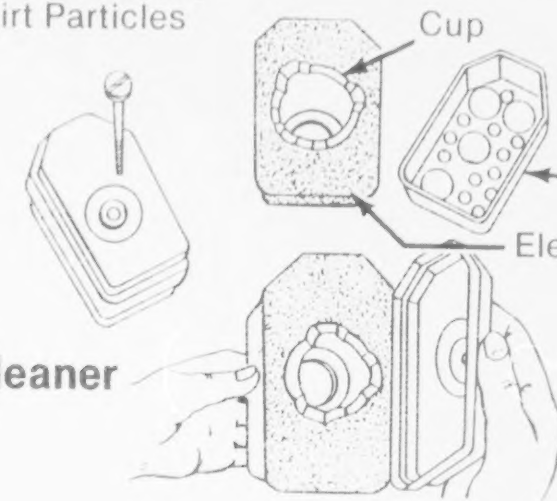
Types of Air Cleaners

Dry-Filter Air Cleaner


Cover
Gasket
Paper Filtering Element
Air Containing Dirt Particles
Clean Air To Carburetor

Oil-Bath Air Cleaner


Air Containing Dirt Particles
Cover
Filter Element
Filter Body
Clean Air To Carburetor


Cup
Body
Element

Polyurethane Air Cleaner

GM 191

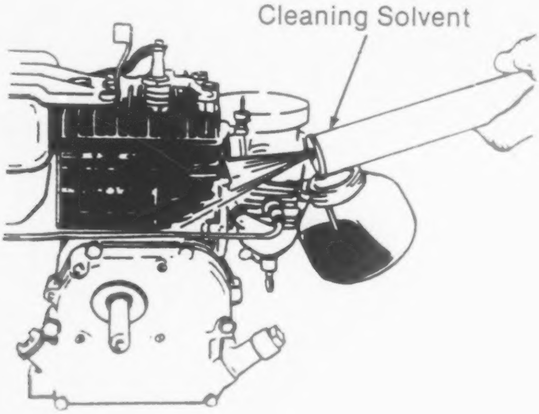
JS 1

REMOVE, CLEAN AND REPLACE AIR COOLING PARTS

Equipment:

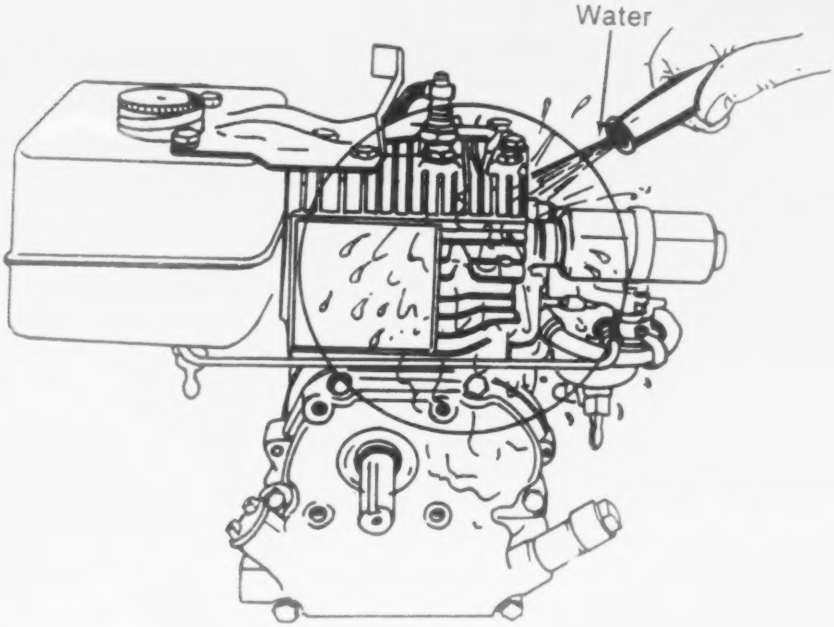
Hand tool assortment
Wire brush
Parts scraper
Wooden scraper
Cleaning solvent
Parts cleaning brush
Small hand sprayer
Safety glasses
Water hose
Compressed air

Procedure:	Evaluation 3	 2	 1	 N
1. Remove blower shroud.	___	___	___	___
2. Remove baffles.	___	___	___	___
3. Pour solvent into sprayer.	___	___	___	___
4. Spray solvent over dirty fins and block areas.	___	___	___	___

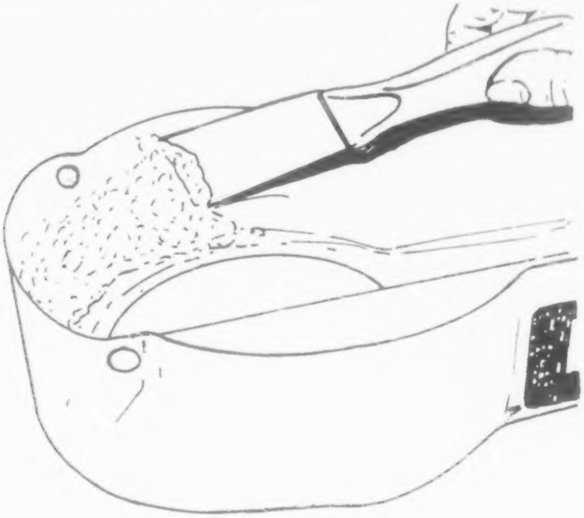


(Note: Let solvent soak long enough to loosen caked or dried dirt or grease.)

5. Wash engine with clear water. — — — —



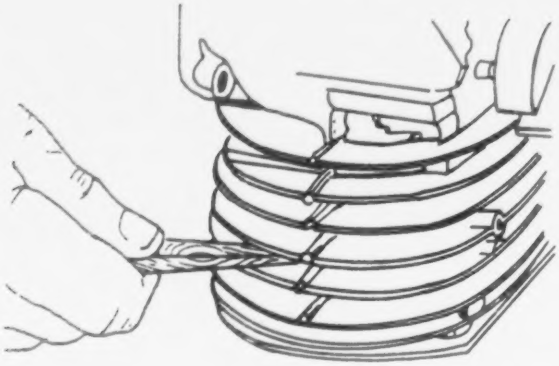
6. Scrape areas that have hard-to-remove accumulations of dirt or grease. — — — —



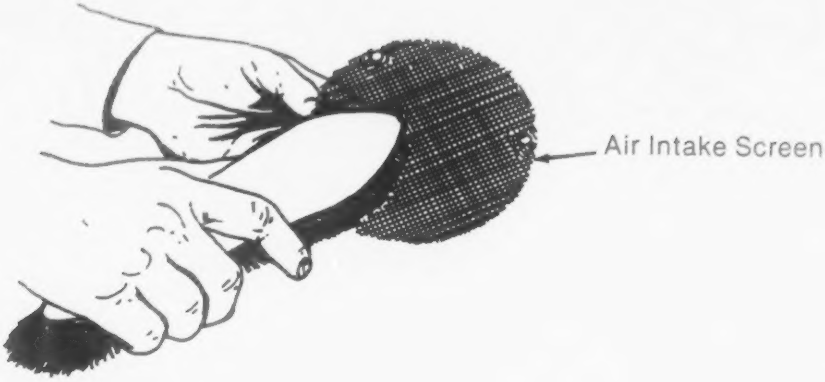
(Note: Use wooden scrapers on aluminum areas like newer engine blocks and fins.)

7. Clean flywheel fins. __ __ __ __

(Note: Replace if necessary.)



8. Clean air intake screen with parts cleaning brush. __ __ __ __



9. Dry engine with compressed air. __ __ __ __

10. Inspect all baffles, shroud and screen for damage. __ __ __ __

11. Reassemble cooling system. ___ ___ ___ ___

(Note: Do not alter the shroud.)

12. Have instructor evaluate your work. ___ ___ ___ ___

13. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ___ ___ ___ ___

Average of above evaluations* ___ ___ ___ ___

*This average is the student's partial evaluation for I-8 of Building Maintenance.

SERVICE AN AIR CLEANER

Equipment:

Compressed air
Container of solvent and cleaning brush
Shop towels
Screwdriver
Clean engine oil
Safety glasses

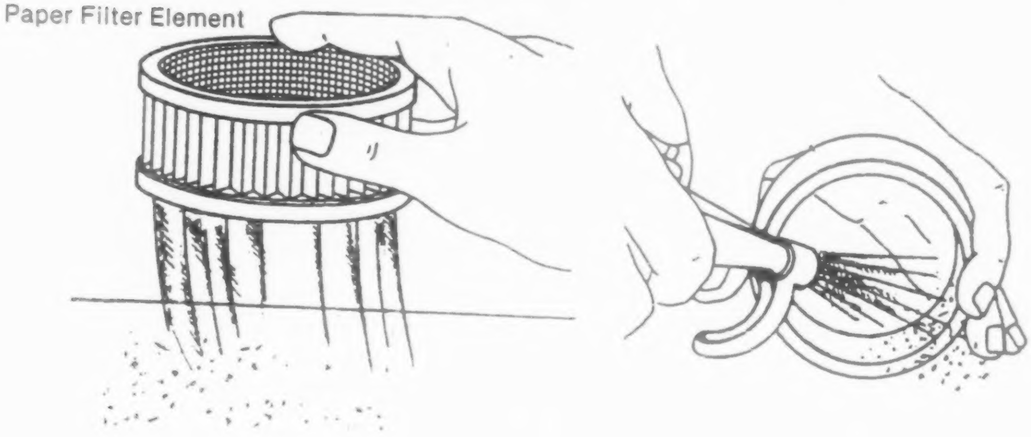
Procedure:

Evaluation
3 2 1 N

1. Disconnect and ground spark plug wire. ___ ___ ___ ___
2. Remove air cleaner fasteners. ___ ___ ___ ___
3. Remove air cleaner and air cleaner cover. ___ ___ ___ ___
4. Determine the type of air cleaner element. ___ ___ ___ ___
5. Service air cleaner according to type.

Paper air cleaner element

A. Clean by tapping lightly on a flat surface or by directing a controlled stream of compressed air through the element opposite normal air flow. ___ ___ ___ ___



B. Before reinstalling, check the element against the light to make sure there are no holes or ruptures present. ____

(Note: Light should be visible. If not, discard element.)

C. Check bottom and top gasket surfaces of the paper element for damage. ____

D. Install right side up when indicated. ____

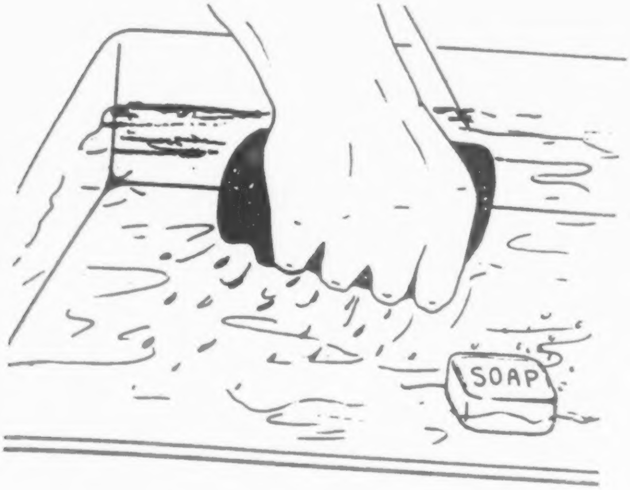
Polyurethane element

A. Remove the polyurethane element from the support screen. ____

B. Wash it thoroughly. ____

(Note: The element can be washed in solvent or soap and water.)

(CAUTION: Never use gasoline to clean element.)

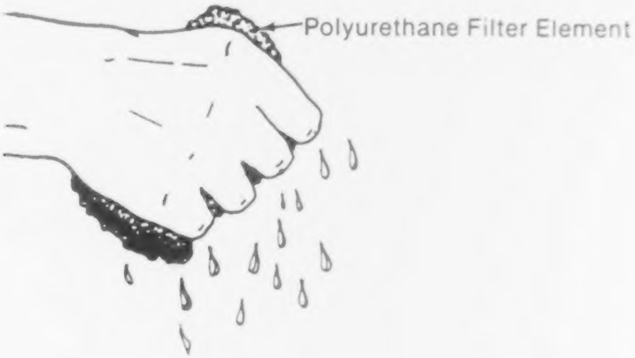


C. Squeeze out the solvent with soap and water. ____

(Note: Do not wring, as the element might tear.)

D. Lubricate the filter element with clean engine oil.

E. Squeeze the excess oil from the filter element.


Polyurethane Filter Element

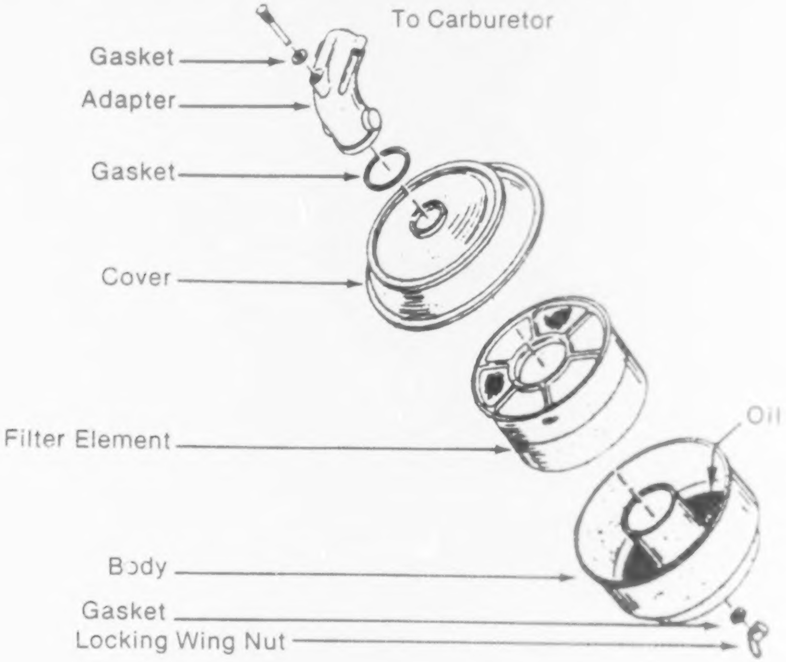
F. Replace element on support screen.

(Note: Make sure the element is placed on the support screen to form a sound seal for both top and bottom contact edges.)

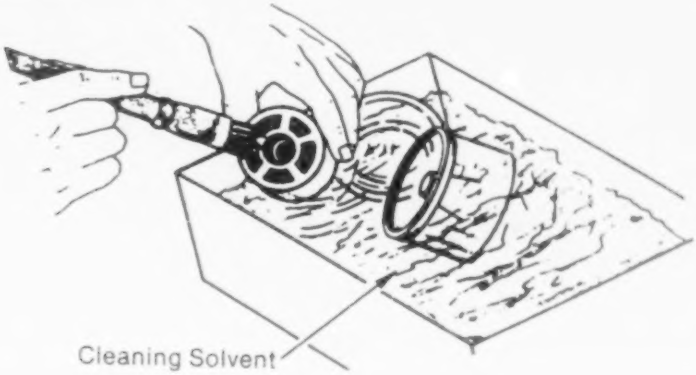
Oil bath air cleaner

A. Remove wing nut and separate parts for cleaning.

(Note: Dispose of old oil properly.)


To Carburetor
Gasket
Adapter
Gasket
Cover
Filter Element
Oil
Body
Gasket
Locking Wing Nut

B. Rinse air strainer and parts in clean solvent. ___ ___ ___ ___



C. Shake excessive solvent out of the air strainer. ___ ___ ___ ___

(CAUTION: Wear eye protection. The solvent is harmful to the eyes.)

D. Saturate the air strainer gauze with light oil and allow excess to drip off. ___ ___ ___ ___

E. Wash dirt and grit out of lower cup with clean solvent. ___ ___ ___ ___

F. Place units together and install wing nut. ___ ___ ___ ___

(Note: Make sure gasket is in place between the air strainer and lower cup.)

G. Tighten wing nut securely. ___ ___ ___ ___

6. Clean the filter body and cover before replacing. ___ ___ ___ ___

7. Make certain the air cleaner to carburetor gasket is in good condition and in place. Replace if necessary. ___ ___ ___ ___

8. Replace the air cleaner body. ___ ___ ___ ___

(Note: Make sure the air cleaner faces in the correct direction. If a locating tang or lug is present, make sure it engages properly.)

9. Tighten the air cleaner wing nut or bolt securely. ___ ___ ___ ___

(Note: Avoid overtightening as this can cause carburetor warpage or improper operation of the choke.)

10. Install any hoses to air cleaner as required. ___ ___ ___ ___

11. Have instructor check your work. ___ ___ ___ ___

12. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials. ___ ___ ___ ___

Average of above evaluations* ___ ___ ___ ___

*This average is the student's partial evaluation for I-8 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT I: GROUNDS MAINTENANCE EQUIPMENT

LESSON 6: AIR FILTER AND COOLING SYSTEMS

LESSON TEST

Part 1. Match the terms below with their correct definitions.

A. Air filter
B. Fin
C. Baffle
D. Conduction
E. Convection
AB. Cooling system
AC. Shroud

______ 1. Heat transfer through a solid material

______ 2. Cover over the finned area of the engine to hold the air around the fins

______ 3. Protrusions cast on the head and cylinder to provide increased surface for additional cooling areas

______ 4. Cover over blower (flywheel) that directs air to the engine fins

______ 5. Heat transfer through movement of a gas

______ 6. Components designed to keep the engine at its most efficient operating temperature during engine operation

______ 7. Filters grit and dust from the air entering the carburetor

Part 2. Match the components of the cooling system on the right with their correct functions.

A. Shroud and baffles
B. Air deflector
C. Flywheel
D. Filter screen

______ 8. Device used to move a large volume of air to the engine

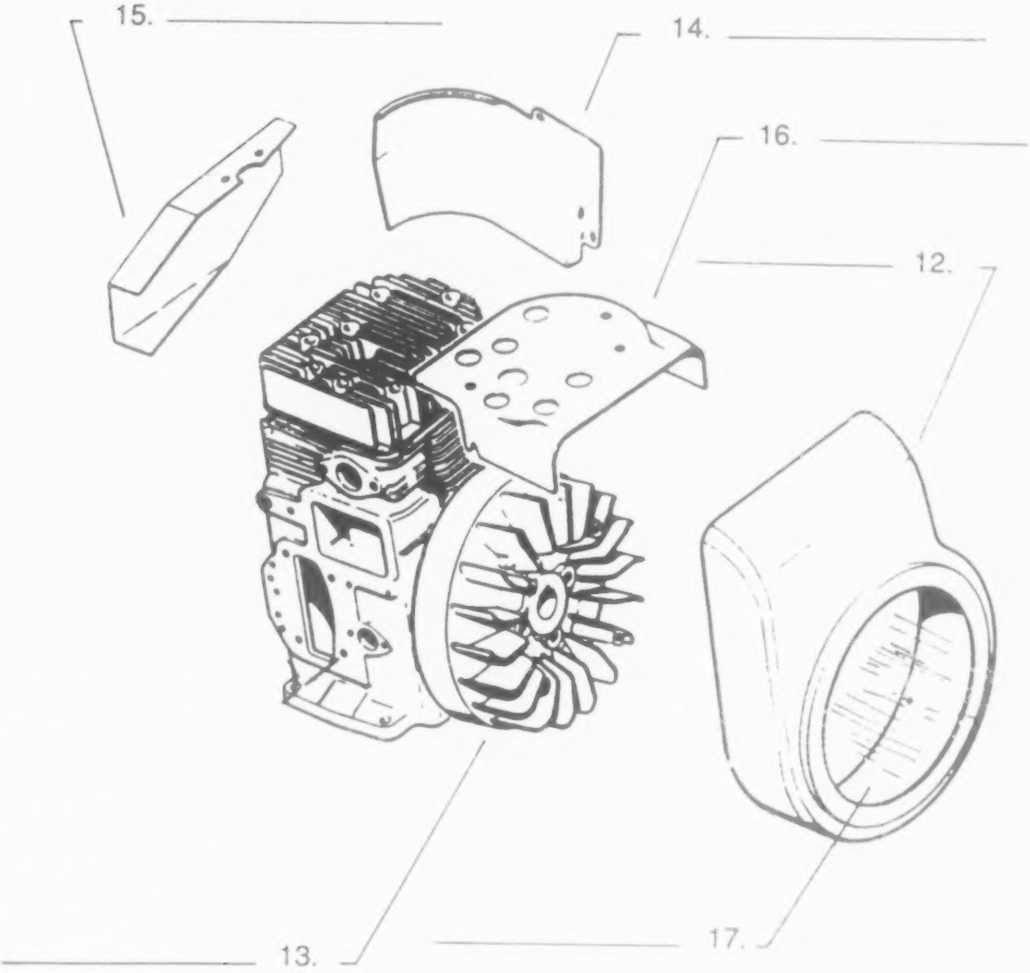
______ 9. Covering on outside of flywheel to filter out large materials in the air stream

______10. Covers flywheel and directs air over the engine fins to promote cooling

______11. Routes the air to cool the engine

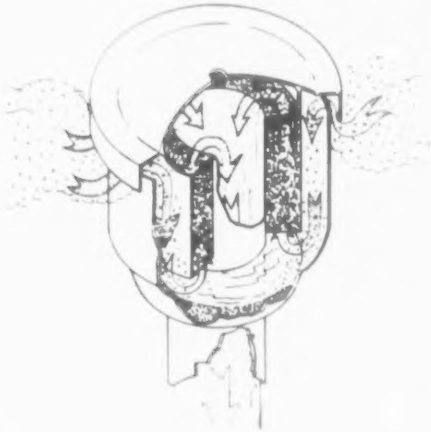
Part 3. Match the components of the cooling system with the correct letter from the list below

A. Air deflector
B. Filter screen
C. Cylinder head baffle
D. Fly wheel
E. Blower shroud
AB. Cylinder baffle

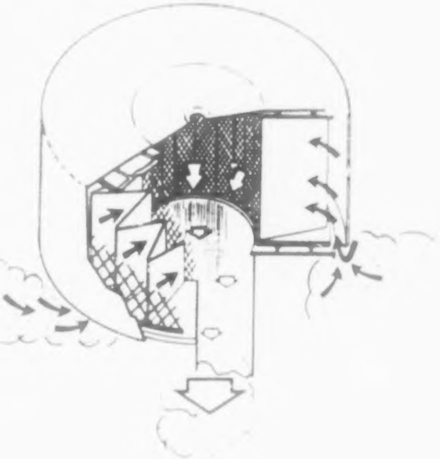


Part 4. Match the types of air cleaners with the correct letter from the list below.

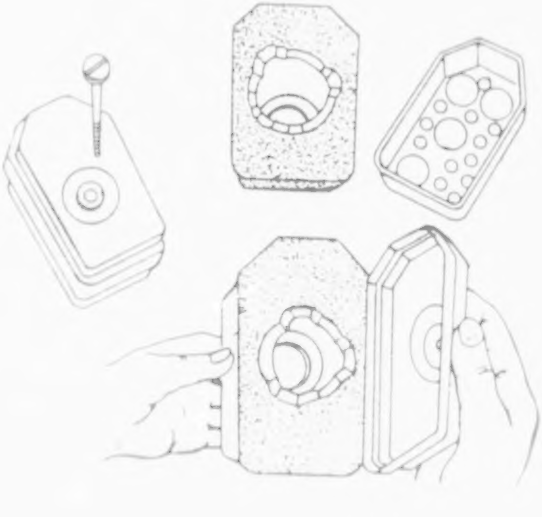
A. Oil bath B. Polyurethane foam
C. Dry filter



18. ____________________



19. ____________________



20. ____________________

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

ANSWERS TO UNIT I, LESSON 6 TEST

Part 1.

1. D
2. C
3. B
4. AC
5. E
6. AB
7. A

Part 2.

8. C
9. D
10. A
11. B

Part 3.

12. E
13. D
14. AB
15. A
16. C
17. B

Part 4.

18. A
19. C
20. B

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 1: MOW AND TRIM GRASS

LESSON OBJECTIVE

After completion of this lesson the student should be able to IDENTIFY MOWING AND TRIMMING EQUIPMENT AND PERFORM MOWING AND TRIMMING OPERATIONS. Mastery will be evidenced by scoring __________ percent on the lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Identify different types of mowing/trimming equipment.
2. Identify correct statements concerning correct mowing/trimming procedures.
3. Perform mower blade height adjustments.
4. Perform mowing and trimming operations.

Completion of the requirements of this lesson fulfills competencies I-11 and J-2 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 1: MOW AND TRIM GRASS

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
   1. Typical rotary mower
   2. Typical trimmers and edger

D. Job sheets
   1. Adjust mower cutting height
   2. Perform mowing and trimming operation

E. Lesson test

F. Answers to lesson test

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 1: MOW AND TRIM GRASS

INFORMATION OUTLINE

I. Terms and definitions (TM 1, TM 2)

  A. Mowing--the cutting of grass with a grass cutting machine to an exact height

  B. Reel mower--a mower with several fixed blades that are part of a cylinder which move against a stationary knife

  (Note: These mowers need lots of maintenance and request adjustment)

  C. Sickle bar mower--a mower designed to cut like a pair of scissors with many blades in line on a bar--used mainly for grasses and weeds more than 4" tall

  D. Rotary mower--a mower with a blade that rotates in a horizontal plane like a scythe or sickle

  E. Scalping--cutting grass too closely with a mower or trimmer

  F. Trimmer--a machine used to cut, trim, or shape the edges of grass areas along walks, drives, or plant beds, or trees--usually uses nylon monofilament line for cutting

  G. Edger--a machine used to cut grass at the edge of walks or drives that uses a blade for cutting

II. Mowing and Trimming Procedures

  A. Mowing should be done at regular intervals--frequency and regularity are more important than mowing height

  B. No more than 1/3 of the green leaf should be removed in one single mowing

  (Note: If a regular mowing is missed, cut only half way back the first mowing, then cut to desired or regular height after two days)

  C. Cutting grass too short does not leave enough green leaf to utilize food/nutrient material for proper growth and root development

D. Common upright grasses, such as Bluegrass, red fescue, and rye grasses should be cut to 1 1/2" - 2" tall--but preferably 2" during cool weather--in hot or dry weather when grass is under stress, raise height to 2" or 3"

(Note: The taller grass shades the ground helping to preserve moisture)

E. Mowers should be kept sharp so that grass is cut cleanly rather than whipped off, shredded or pulled up by the roots

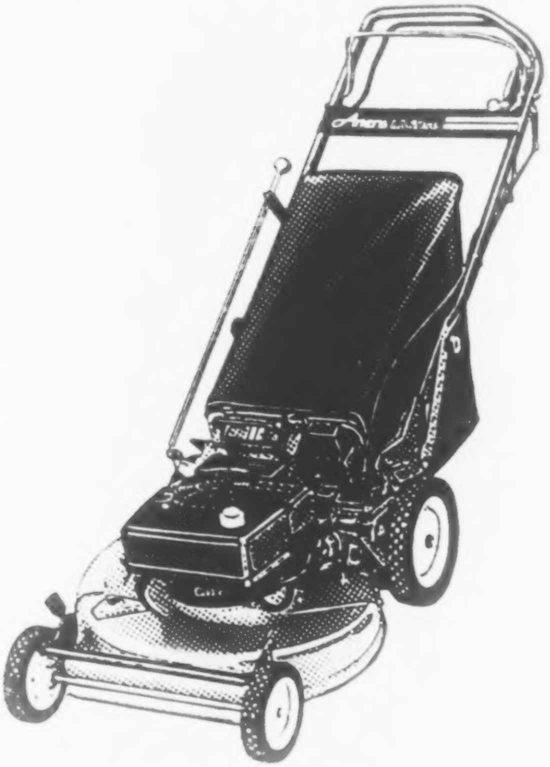
F. Mower height should be set exactly after determining the amount of grass to be removed

G. Proper mowing practices help to control insects and disease, improves appearance, and reduces the amount of weeds

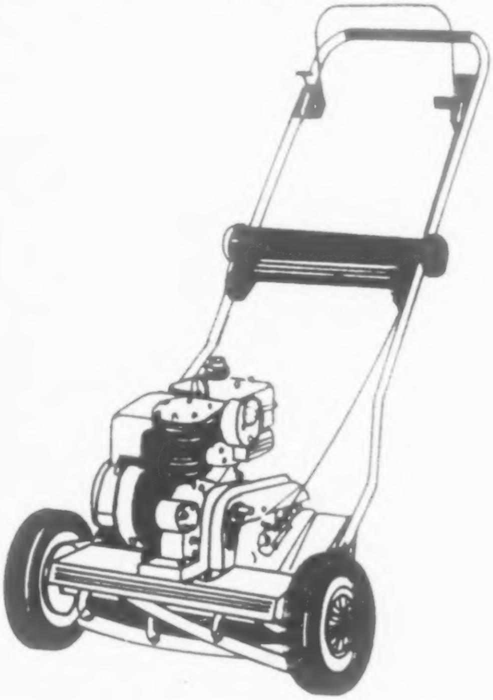
Typical Rotary Mower

TM 1

A. Rotary walk-behind mower

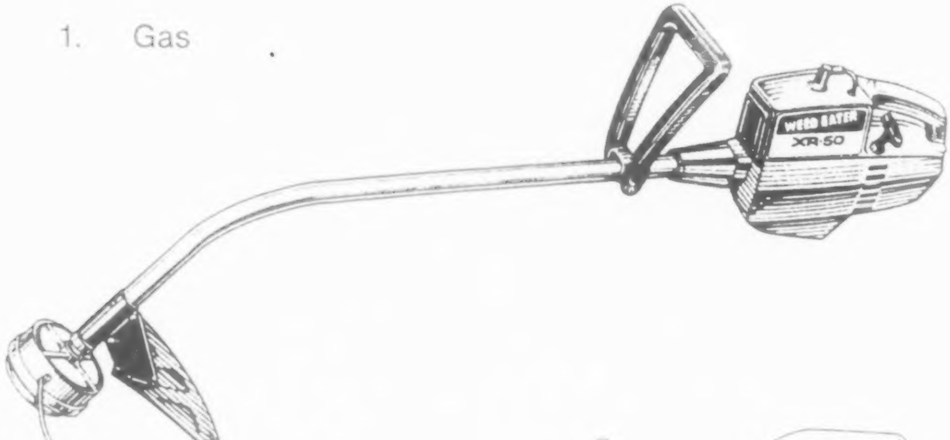


B. Reel mower

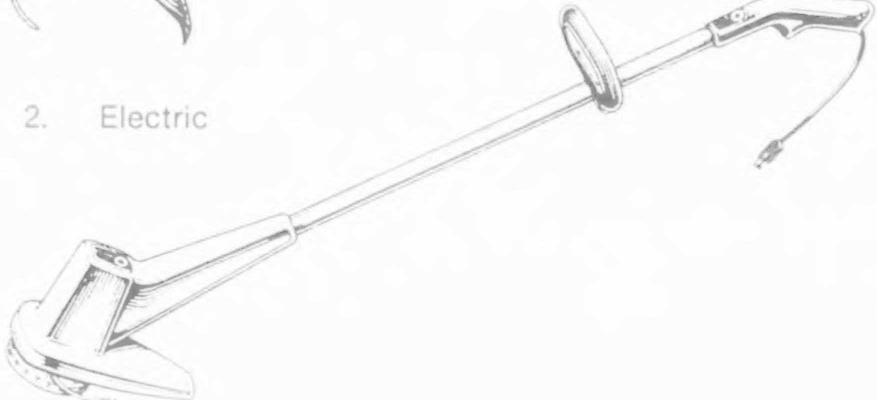


Typical Trimmers and Edger

1. Gas


WEED EATER
XR-50

2. Electric



ADJUST MOWER CUTTING HEIGHT

Equipment:

If the mower has a lever type adjustment system no tools are required. If the bolt/nut system is used, select tools required by the specific model of mower that is being used.

Safety Glasses

Procedure:	Evaluation 3	 2	 1	 N
1. Determine the height of grass to be mowed.	___	___	___	___
2. Set mower blade height to remove 1/3 of the grass blade.	___	___	___	___
3. Tighten any loose nuts and bolts securely.	___	___	___	___
4. Mow a small area and check for proper cutting height.	___	___	___	___
5. Re-adjust as necessary.	___	___	___	___

JS 2

PERFORM MOWING AND TRIMMING OPERATION

Equipment:

Mower or trimmer as determined by instructor
Eye protection or face shield
Boots

	Evaluation			
Procedure:	3	2	1	N
1. Set up equipment as required--check with instructor.	___	___	___	___
2. Mow or trim as directed by instructor.	___	___	___	___
3. Clean and store equipment.	___		___	___

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 1: MOWING AND TRIMMING GRASS

LESSON TEST

Part 1. Place an X on the blank beside each correct statement.

____ 1. No regular schedule of mowing needs to be established

____ 2. Mowing height of grass is more important than frequency

____ 3. Mower height should be set exactly after determining how much grass to remove

____ 4. If a regular mowing is missed, cut back as close as possible the next mowing

Part 2. Answer the following sentences by writing the letter of the correct answer on the blank.

____ 5. No more than __________ of the green leaf should be removed in one mowing

A. 3/4
B. 1/3
C. 1/2
D. 1/4

____ 6. Proper mowing practices helps to:

A. control insects
B. control weeds
C. improve appearance
D. control disease
E. all of the above

____ 7. Bluegrass, fescue and rye grass should be cut 1 1/2" to 2" in cool weather. In hot weather the height should be:

A. 1/4" to 1/2"
B. 4" to 6"
C. 2" to 3"
D. 3" to 5"
E. none of the above

____ 8. The hazard zone around a line trimmer should be a circle that is:

A. 30 ft. in diameter
B. 40 ft. in diameter
C. 50 ft. in diameter
D. 20 ft. in diameter
E. 60 ft. in diameter

____ 9. The safety equipment required while operating a string trimmer are:

A. goggles or face shield
B. boots and heavy pants
C. both A and B above
D. none of the above

____ 10. The operations that can be done with a string trimmer are:

A. mowing
B. trimming
C. edging
D. all of the above
E. only "B" above

____ 11. A mower most often used for grass and weeds more than 4 inches tall is the:

A. Sickle bar mower
B. Rotary mower
C. Reel mower
D. Edger mower

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

ANSWERS TO UNIT II, LESSON 1 TEST

Part 1.

1.
2.
3. X
4.

Part 2.

5. B
6. E
7. C
8. E
9. C
10. D
11. A

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 2: PRUNING TREES, SHRUBS AND VINES

LESSON OBJECTIVE

After completion of this lesson, the student will be able to DEMONSTRATE KNOWLEDGE OF THE GENERAL RULES OF PRUNING AND HOW TO USE PRUNING TOOLS. Mastery will be evidenced by completion of job sheet and by scoring ___________ percent on lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match terms pertaining to pruning with their definitions.
2. Choose from given statements those that are true of pruning.
3. List three important aspects of plant maintenance.
4. Identify two methods of pruning.
5. Identify as true or false statements about stem pruning.
6. Identify as true or false statements about root pruning.
7. Choose from given statements those that concern "heading back."
8. Choose from given statements those that concern "thinning out."
9. Identify pruning tools.
10. Select true statements about pruning.
11. Match terms concerning pruning ornamental trees to their definitions.
12. Select true statements concerning removing dead, diseased or injured branches from ornamental trees.
13. Select as true statements pertaining to the pruning and shaping of a tree.
14. Select statements that describe procedures for pruning ornamental trees to strengthen trunk and branches.

15. Select true statements about pruning deciduous shrubs immediately after flowering.

16. Choose statements that apply to pruning deciduous shrubs with ornamental fruits.

17. Choose statements that are true of sanitary pruning of broadleafed evergreens.

18. List four general facts about ornamental vines.

19. State four training methods for ornamental vines.

20. Perform a pruning project.

Completion of the requirements of this lesson fulfills competency J-3 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 2: PRUNING TREES, SHRUBS AND VINES

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
    1. Pruning methods
    2. Pruning tools
    3. Removing dead, diseased, or injured branches
    4. Pruning to shape
    5. Training methods for vines

D. Job sheet
    1. Perform a pruning project

E. Lesson test

F. Answers to lesson test

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 2: PRUNING TREES, SHRUBS AND VINES

INFORMATION OUTLINE

I. Terms and definitions

  A. Pruning--the removal of parts of the top or root system of plants

  B. Fruit spurs--stubby fruit-bearing twigs up to three inches long

  C. Translocation--the movement (conduction) of water-soluble organic materials and minerals from one part of the plant to another part

  D. Inhibit--to prohibit or slow down an action

  E. Hormones--chemical compounds that are produced in one part of a plant and move to another part of the plant

  F. Twig--a very small branch of a tree

  G. Cane--a stem of various fruits, such as the raspberry or blackberry

  H. Shoot--a small outgrowth on a bush

II. Facts about pruning

  A. Pruning is a task that generally has no specific season

  B. It is a continuous process

  C. It serves a purpose for the plant

  D. It enhances the ornamental value of plants

  E. Generally prune with the natural form of a plant, not against it

III. Purposes of pruning

  A. To remove diseased, dead, or damaged limbs

  B. To restrict or promote growth

C. To encourage or improve blooming

D. To develop certain forms of growth

IV. Methods of pruning (TM 1)

A. Stem pruning

B. Root pruning

V. Facts about stem pruning

A. Reduces the amount of growth

B. Influences the vegetative-reproductive balance of the plant

C. Removal of healthy stems and leaves reduces plant size, yield, and the total amount of growth

D. Increases the supply of essential elements to the points of growth that remain

E. Promotes the making of cells and the use of carbohydrates

F. Stimulates the vegetative phase and retards the reproductive phase

VI. Facts about root pruning

A. Affects the total amount of growth made

B. Influences the vegetative-reproductive balance of the plant

C. Reduces the amount of available essential elements and water that would go to the top of the plant--causes the plant to have a dwarf form

D. Promotes root growth--the roots use the carbohydrates manufactured by the plant, and thus cause the plant to be dwarfed

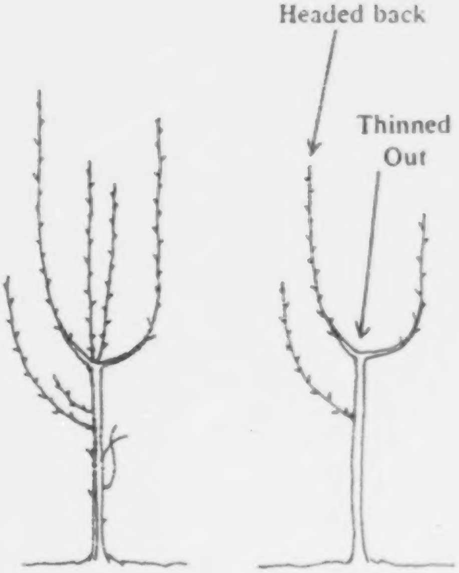
E. Favors reproduction and retards vegetative phases of the plant

F. Also used to prepare a plant for transplanting

VII. Types of top pruning

A. Heading back

B. Thinning out



VIII. Facts about heading-back pruning

A. Terminal (top) portion of twigs, canes or shoots are removed

B. Stimulates the development of more points of growth
   1. Terminal buds on shoots secrete growth-inhibiting hormones that are translocated to the lateral buds
   2. Lateral buds just below the cut manufacture the growth-inhibitor hormones that prevent the development of lateral buds farther down the stem

C. Induces compact, dense, or branched type of growth

IX. Facts about thinning-out pruning

A. Entire twig, cane, or shoot is removed

B. Does not prevent the development of lateral buds

C. Induces open type of growth

X. Some general rules for pruning

A. Use only sharp, proper tools for the job

B. Prune back to an existing bud (about 1/4 inch above it) or to a side branch--NEVER LEAVE A STUB

C. Cut larger limbs in three steps

1. Make an undercut on the limb 9 to 12 inches from the main trunk, cutting into about 1/3 of the limb's diameter
2. Go out about an inch or two from the undercut and begin cutting into the top of the limb--as the saw cuts into the wood, the weight of the limb will cause a separation to take place between these two cuts and the limb will fall
3. Cut off the stump that remains flush with the main trunk--once the final cut is made, cover the cut area with tree paint

D. Pruning in the summer results in a greater dwarfing of trees than pruning in the late winter

E. Buy and plant trees and shrubs that have the characteristics, mature size, and shape you want--do not count on pruning to keep tall plants short and spreading plants narrow

XI. Pruning tools and how to use them (TM 2)

A. Your own thumb and forefinger--the most important tools

1. Pinch off any lanky shoots that may spoil the symmetry of perennials or shrubs
2. Rub out unwanted buds, long stems and fruit spurs
3. Snap off faded blooms or seed pods

B. Edgers

1. Enable the user to stand up to cut the edges of lawns
2. Will also cut the edges of thick, spreading ground covers such as ivy and vines

C. Grass shears--use only for shearing grass (not good for other plants)

D. Loping shears

1. Used wherever the added leverage of long handles will make an easier cut
2. Used for reaching farther into a tree
3. Used on small branches of twigs

E. Pruning shears

1. Essential part of any gardener's tool kit
2. There are many different kinds for different tasks, such as:
   - a. small pruning jobs
   - b. Bonsai pruning--makes a concave depression, heals fast

    c. flower shears--have blades designed to cut and hold flower stems
    d. fruit shears--cut stems of fruits that don't break off (lemons and oranges)
    e. extension shears--used for cutting flowers and doing other light pruning beyond arm's reach

F. Hedge shears
  1. Hand-operated with various size handles
  2. Generally have one blade serrated and notched--the notch holds bigger twigs for non-slip slicing

G. Pruning saws
  1. Designed to cut quickly through fresh green, wet wood
  2. Curved saws have teeth made to cut on the pull stroke--useful for overhead work
  3. Straight saws have teeth made to cut on the push stroke

H. Pole pruners and pole saws
  1. Used to cut or to saw branches high overhead
  2. A telescoping lightweight metal tube or wooden poles that lock together making an extension of up to 18 feet at the end of which the pruning units are attached

(CAUTION: When using pole pruners or saws, be sure to avoid any contact with electrical power lines!)

I. Chain saws--for pruning large material

(CAUTION: Never raise or lower a chain saw that is running and not cutting!)

ORNAMENTAL TREES

XII. Terms and definitions

A. Pleach--to interweave and plait branches of trees together to form a hedge or arbor

B. Pollard--a tree from which the top has been sheared so that it puts out a dense head of slender shoots

C. Deciduous tree--tree that looses its leaves in the winter

D. Thinned out--with the entire branch, shoot, cane, or twig removed to the basal stem

E. Headed back--with the end of a branch, shoot, cane or twig removed

F. Espalier--describing a tree or shrub trained to grow flat against a wall or along a fence, wire, or trellis

G. Topiary--describing trees or shrubs sheared to geometric shapes, such as pyramids, spheres, cones, etc

XIII. Two general reasons for pruning ornamental trees

A. To remove dead, diseased or injured branches

B. To keep the trees within the dimensions of the area

XIV. General rules for removing dead, diseased, or injured branches (TM 3)

A. Remove all stubs

B. Sterilize all pruning tools after removing diseased branches (dip tools in a solution of 1/2 cup of Clorox per one gallon of water)

C. Seal cuts to prevent disease and keep out rot

D. Cut back frost-bitten wood a little at a time

XV. General rules for keeping trees within dimensions of an area

A. Deciduous trees
1. Pinch out tips of branches at low level
2. Remove lower branches in the third or fourth year or when the head of the tree is large enough to take over growth
3. Prune in late winter when the branches are bare
4. Some trees can also be pinched back, cleaned up or sheared in the summer or fall

B. Coniferous trees
1. Conifers need to be pinched, headed back, and thinned out depending on type and variety
2. Conifers--such as junipers--must be pruned regularly to keep them in bounds
3. Prune generally just before Christmas
4. Tree forms need less pruning than lower growing forms
5. Some evergreens--such as the arborvitae--need heavy shearing in the spring

XVI. Pruning to shape (TM 4)

- A. To permit traffic to circulate under the tree
- B. To make various designs such as:
    1. An arbor by pleaching
    2. Espalier
    3. Topiary
    4. Pollard

XVII. Pruning to strengthen trunk and branches

- A. Some trees grow too fast and produce long, soft, brittle growth that is easily damaged by wind and weight of water on the leaves
    1. Cut back hard after the tree has been in the ground for at least a year and has developed a sturdy root system
    2. Cut to a side branch or bud, if possible
    3. New buds will form and branches will form from them
    4. Do this between March and August to allow growing time before frost
    5. Later go back and take out all except one (or several) branches
- B. Some trees "weep" to the ground--they must be trimmed to give aeration and strength to the tree

XVIII. Pruning for specific landscape use

- A. To conform with the area available
- B. To use the area to the best advantage

DECIDUOUS AND EVERGREEN SHRUBS

XIX. Reasons for removing unwanted growth from deciduous shrubs

- A. To produce more or better bloom and/or fruit
- B. To develop or maintain a desired shape or size
- C. To rejuvenate (make young again) by taking out older stems to encourage vigorous young ones to take their places
- D. To repair injuries
- E. To remove parts diseased or seriously injured by insects, such as fireblight, stem boers, scale insects, etc

F. To establish a balance between root and branch systems after transplanting, particularly shrubs moved with bare roots

G. To remove dead wood or that which is winter-killed

XX. Facts about proper pruning tools for pruning shrubs

A. Tools should be of good steel and always kept sharp

B. Hand pruning shears come in sizes 7 to 9 inches long (the heavier type is preferred because its cutting blades are not so easily strained)

C. Pruning saws 12 to 14 inches long are large enough for most shrubs

D. Lopping shears with handles from 20 to 36 inches are used to cut stems from 3/4 to 1-1/2 inches in diameter where saws cannot be used

E. A heavy pruning knife is usable for many purposes, especially for smoothing surfaces cut with a saw

(Note: Do not use hedge shears for pruning shrubs)

XXI. Seasons for pruning deciduous shrubs

A. In the winter when they are dormant, before growth begins in the spring

B. Immediately after flowering (spring or early summer)

XXII. How to prune deciduous shrubs immediately after flowering

A. Cut away the branches that have flowered

B. Leave only the vigorous young shoots

C. Older shoots (remaining from the previous year) should be cut out at ground level

D. If pruning cannot be done at this time, an alternate time is in the winter--in winter, remove only the old stems at their bases

XXIII. How to prune deciduous shrubs with ornamental fruits (used for autumn fruits rather than spring flowers)

A. Occasionally in the dormant season, the shrubs can be lightly thinned out

B. Cut out old or weak stems

C. Remove stems that are rubbing together

VINES

XXIV. Terms and definitions

A. Tendrils--modified leaf

B. Dowel--round wooden rod

C. Variegated--several colors

XXV. Some general facts about ornamental vines (TM 5)

A. All vines require some kind of support

B. Most vines require some pruning to prevent tangling

C. Most vines require some pruning to get good coverage for the area

D. Some vines require no pruning except to remove diseased and injured tendrils and branches

E. Some vines are produced for vegetables, flowers for cutting, or flowers for display

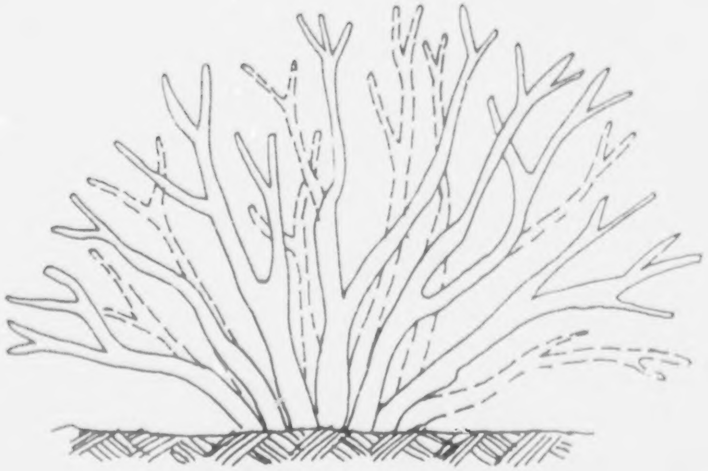
F. Some vines are produced for their striking foliage, both evergreen and deciduous

G. Some vines are produced for their fruit, such as the grape

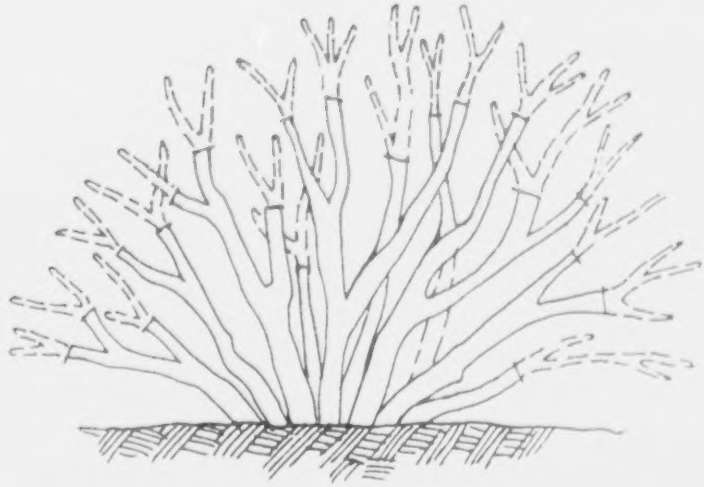
XXVI. Methods of training ornamental vines

A. Ornamental vines must be pruned--use general pruning techniques (section X of this lesson)
   1. Vertical support--examples: morning glories, passion vines, sweet peas
   2. For fence support--attach vines to wood strips, secured with wire--any design can be achieved by pruning (head back and thin out)
   3. For hinged trellises--vines attached to a framework that can be pulled back for painting walls
   4. For lattice screens--vines can be pruned to be windbreaks and screens for privacy
   5. For vine-draped dowel--edges of eaves can be softened by this method with proper pruning

Pruning Methods



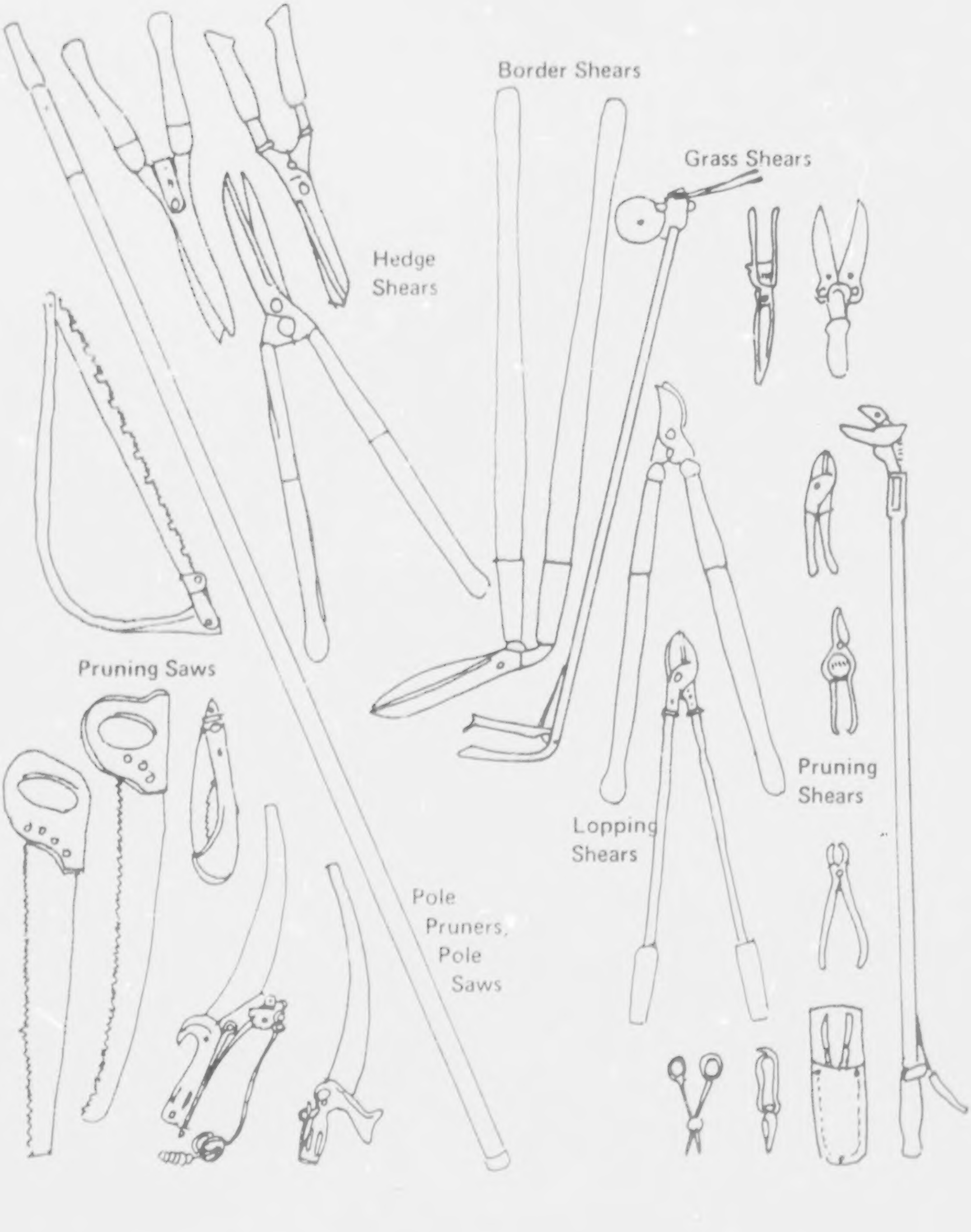
Correct Method



Incorrect Method

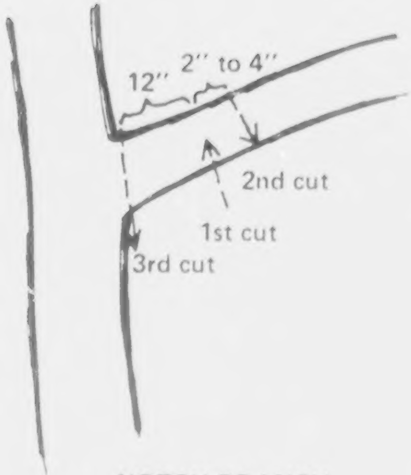
TM 2

Pruning Tools

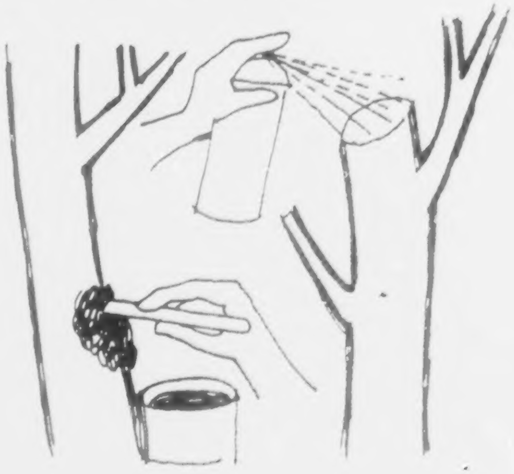

Border Shears
Grass Shears
Hedge Shears
Pruning Saws
Pole Pruners, Pole Saws
Lopping Shears
Pruning Shears

TM 3

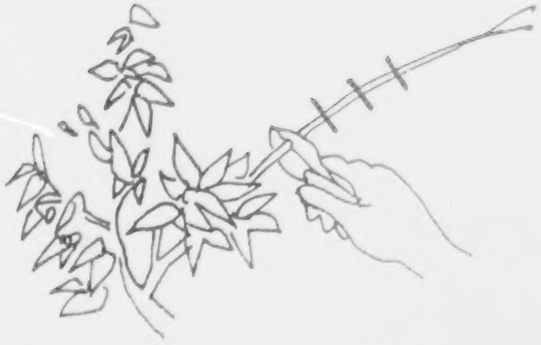
Removing Dead, Diseased, or Injured Branches


12"
2" to 4"
2nd cut
1st cut
3rd cut

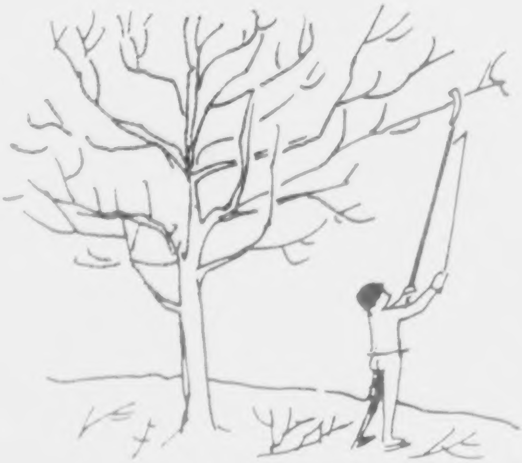
NOTCH BRANCH



SEAL CUTS



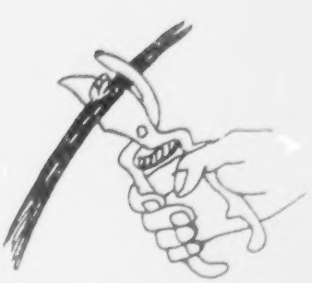
To prune frost-killed branch, cut off short pieces, stop at green wood.



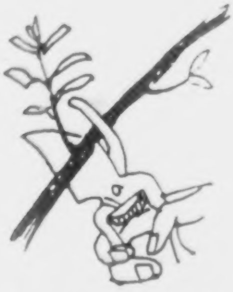
USE POLE PRUNER

TM 4

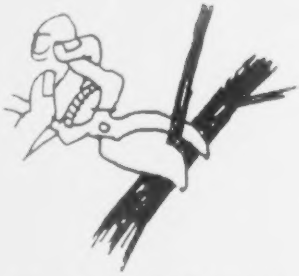
Pruning to Shape



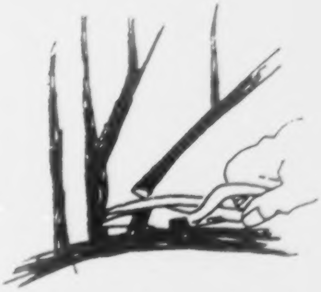
Just above the bud.



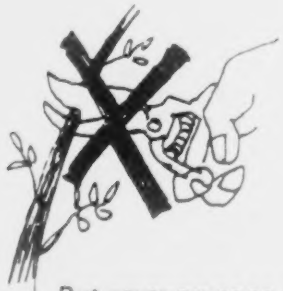
Above a healthy side branch.



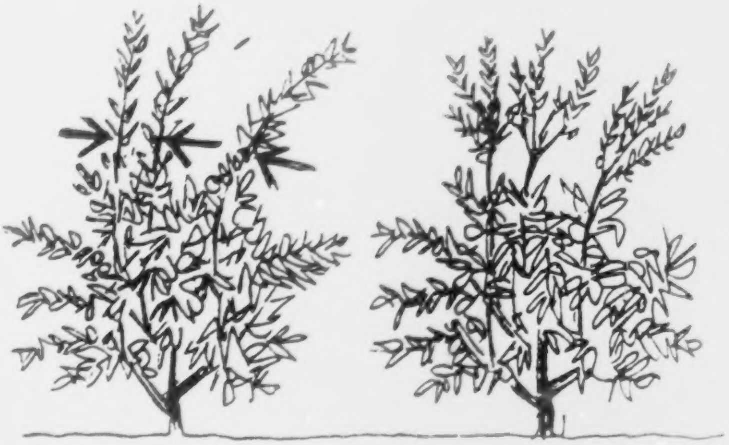
Leave only main branch.



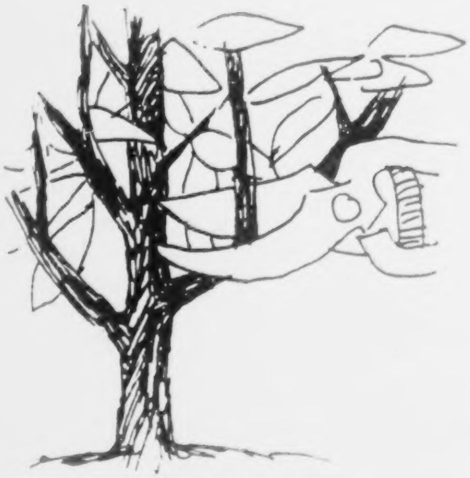
Cut to base or ground; file off stubs.



But never prune so that long stubs remain.



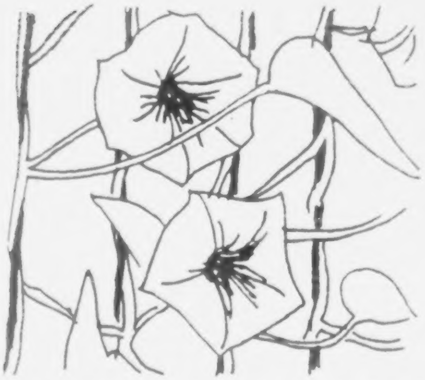
If you cut at points shown by large arrows, stubs may sprout at cut.

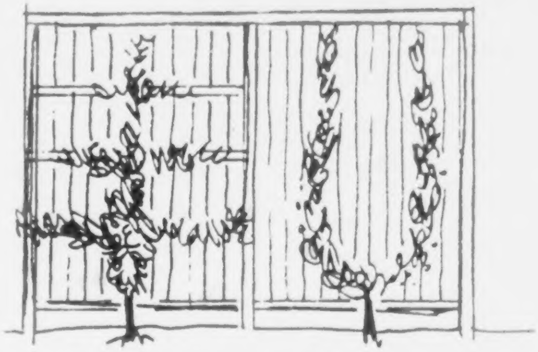


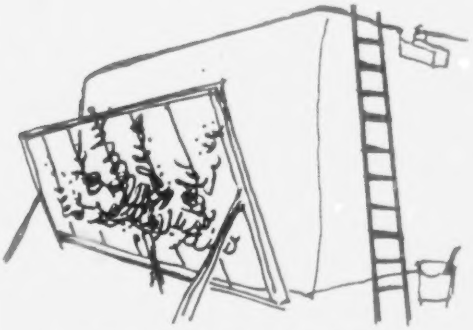
Instead, cut off runaways at base.

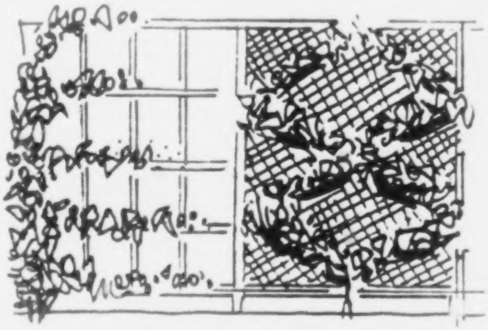
TM 5

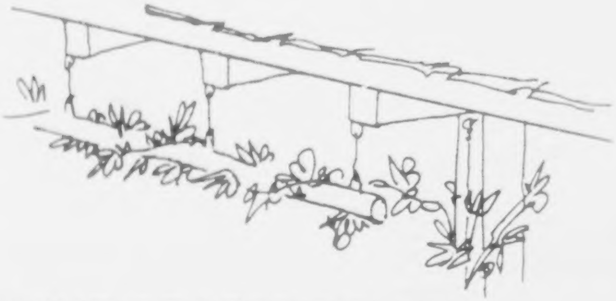
Training Methods for Vines


VERTICAL SUPPORT


FENCE SUPPORT


HINGED SUPPORT


LATTICE SCREEN


VINE-DRAPED DOWEL

PERFORM A PRUNING PROJECT

Instructor will choose a pruning project and give job sheet instructions to fit.

Equipment:

Procedure:

Evaluation
3 2 1 N

Average of above evaluations* ___ ___ ___ ___

*This average is the student's partial evaluation for competency J-3 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 2: PRUNING TREES, SHRUBS AND VINES

LESSON TEST

Part 1. Match the terms pertaining to pruning to their correct definitions.

A. Inhibit
B. Fruit spurs
C. Hormones
D. Pruning
E. Translocation
AB. Twig
AC. Cane
AD. Shoot

____ 1. The removal of parts of the top or root system of plants

____ 2. Stubby fruit-bearing twigs up to three inches long

____ 3. The movement (conduction) of water-soluble organic materials and minerals from one part of the plant to another part

____ 4. To prohibit or slow down an action

____ 5. Chemical compounds that are produced in one part of a plant and move to another part of the plant

____ 6. A very small branch of a tree

____ 7. A stem of various fruits, such as the raspberry or blackberry

____ 8. A small outgrowth on a bush

Part 2. Place a "T" on the blank beside each statement that is true of pruning. Place an "F" beside each false statement.

____ 9. Pruning is a task that has no specific season

____ 10. Skills are not necessary to prune plants successfully

____ 11. It is a continuous process

____ 12 It does nothing for the value of the plants

____ 13. Prune with the natural form of the plant, not against it

____ 14. It performs a purpose for the plant

____ 15. Pruning removes diseased, dead, or damaged limbs

____ 16. Pruning provides work for low-skilled employees

____ 17. Pruning restricts or promotes plant growth

____ 18. Pruning encourages or improves blooming

Part 3. Place an "X" on the blank beside each type of pruning.

____ 19. Stem

____ 20. Root

____ 21. Bud

____ 22. Leaf

Part 4. Place a "T" on the blank beside each true statement about stem pruning. Place an "F" beside each false statement.

____ 23. Reduces the amount of growth

____ 24. Does not influence the vegetative-reproductive balance of the plant

____ 25. Removal of healthy stems and leaves reduces plant size and yield

____ 26. Promotes the making of cells and the use of carbohydrates

____ 27. Stimulates the vegetative phase and retards the reproductive phase

Part 5. Place a "T" on the blank beside each true statement about root pruning. Place an "F" beside each false statement.

____ 28. Affects the total amount of growth made

____ 29. Influences the vegetative-reproductive balance of the plant

____ 30. Increases the amount of available essential elements and water that go to the top of the plant

____ 31. Favors reproduction and retards vegetative phases of the plant

____ 32. Used to prepare a plant for transplanting

Part 6. Place a "T" on the blank beside each true statement about "heading back" (top pruning). Place an "F" beside each false statement.

____ 33. Terminal portion of twigs, canes, or shoots are removed

____ 34. Basal portion is removed

____ 35. Stimulates the development of more growing points

____ 36. Induces compact, dense, or much branched type of growth

Part 7. Place a "T" on the blank beside each true statement about "thinning out" (top pruning). Place an "F" beside each false statement.

____ 37. Entire twig, cane or shoot is removed

____ 38. Prevents the development of lateral buds

____ 39. Induces open or rangy type of growth

Part 8. Place a "T" on the blank beside each general rule for pruning. Place an "F" on the blank beside each statement that is not a general rule of pruning.

____ 40. Use only sharp, proper tools for the job

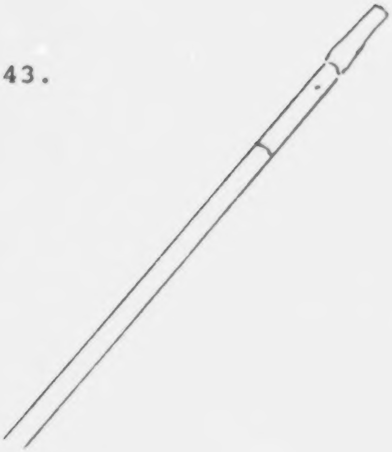
____ 41. Prune back to an existing bud or to a side branch--don't leave a stub

____ 42. Once you have cut a limb, leave the area alone--allow the sap to flow to the spot for self-healing

Part 9. Identify each pruning tool or group of tools by matching the names below with the correct illustration.

A. Pruning shears
B. Pruning saws
C. Grass shears
D. Pole pruners, pole saws
E. Hedge shears
AB. Lopping shears
AC. Border shears

____ 43.



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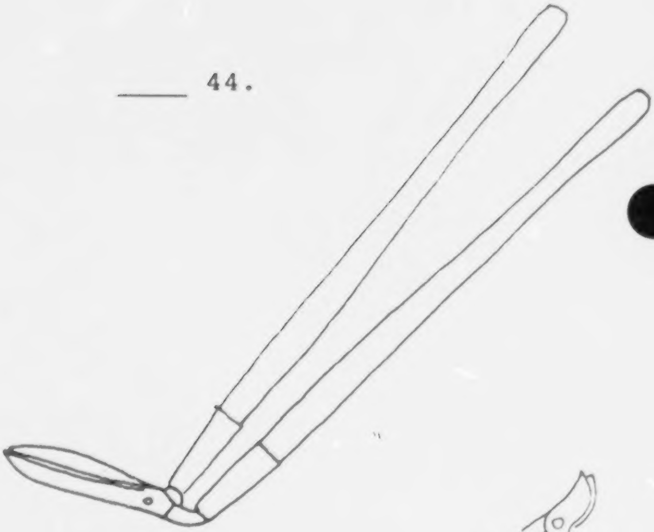

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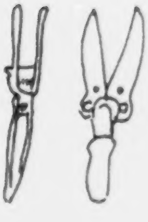

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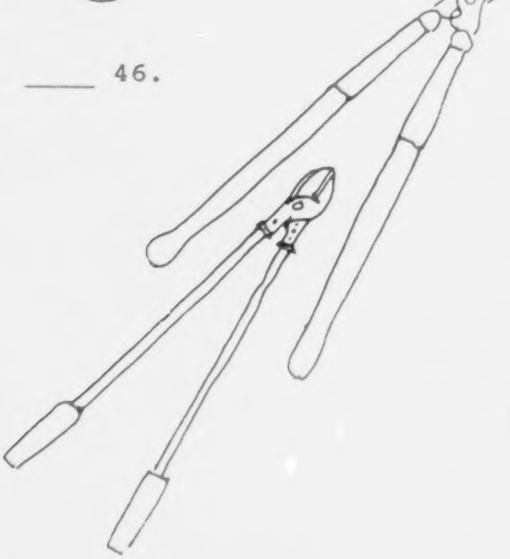
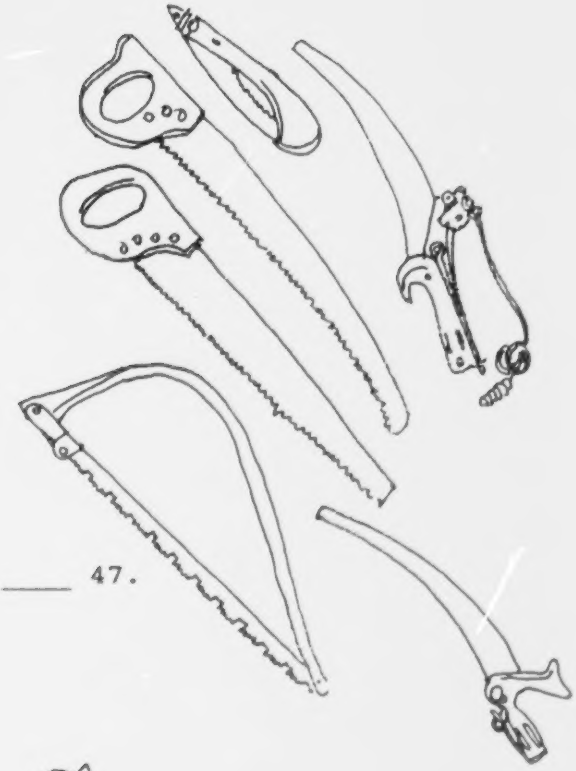
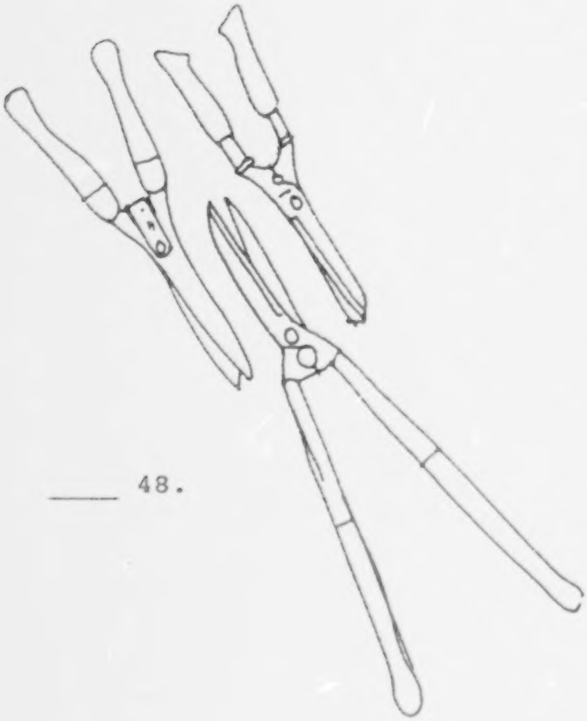
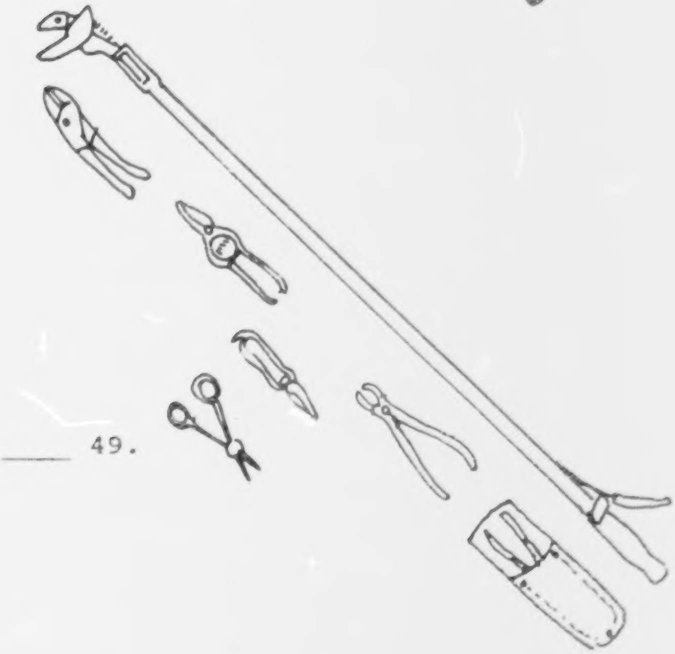




____ 47.



____ 48.



____ 49.

Part 10. Match the terms concerning pruning ornamental trees below to their correct definitions.

A.	Topiary	E.	Headed back
B.	Pleach	AB.	Espalier
C.	Deciduous tree	AC.	Thinned out
D.	Pollard		

____ 50. To interweave and plait branches of trees together to form a hedge or arbor

____ 51. A tree from which the top has been sheared so that it puts out a dense head of slender shoots

____ 52. Tree that looses its leaves in the winter

____ 53. With the entire branch, shoot, cane, or twig removed to the basal stem

____ 54. With the end of a branch, shoot, cane or twig removed

____ 55. Describing a tree or shrub trained to grow flat against a wall or along a fence, wire, or trellis

____ 56. Describing trees or shrubs sheared to geometric shapes, such as pyramids, spheres, cones, etc

Part 11. Place a "T" on the blank beside each true statement about removing dead, diseased or injured branches from ornamental trees. Place an "F" beside each false statement.

____ 57. Leave some stubs

____ 58. Keep the pruning tools sterilized at all times

____ 59. Do not seal cuts

____ 60. Cut back frostbitten wood a little at a time

Part 12. Place a "T" on the blank beside each true statement about pruning to shape an ornamental tree. Place an "F" beside each false statement.

____ 61. To permit traffic to circulate under the tree

____ 62. To make various designs, such as an arbor by pleaching

____ 63. Topiary trees grow naturally

____ 64. "Weeping trees" that reach the ground must be trimmed in order for the tree to have aeration for the trunk and branches to grow strong

Part 13. Place a "T" on the blank beside each true statement about pruning ornamental trees to strengthen trunk and branches. Place an "F" beside each false statement.

____ 65. If the tree is fast-growing and produces brittle growth, it should be cut back hard after it has a sturdy root system

____ 66. A fast-growing brittle tree will form new buds if they are cut back to a bud

____ 67. Cut back fast-growing brittle trees between August and October

____ 68. "Weeping trees" must be trimmed to give aeration and strength to the tree

Part 14. Place a "T" on the blank beside each true statement about pruning deciduous shrubs after flowering. Place an "F" beside each false statement.

____ 69. Cut away the branches that have flowered

____ 70. Leave only the old shoots

____ 71. Cut the tips from the old shoots

____ 72. This pruning can be done in the winter as an alternate time

Part 15. Place a "T" on the blank beside each true statement about pruning deciduous shrubs with ornamental fruits. Place an "F" beside each false statement.

____ 73. Occasionally in the dormant season, the shrubs can be lightly thinned out

____ 74. Do not remove the old or weak stems

____ 75. Remove the stems that are rubbing together

____ 76. Do no systematic shoot or branch pruning

____ 77. Prune three times a year

____ 78. Prune enough to keep them neat but not formal in appearance

Part 16. Place a "T" on the blank beside each true statement about the sanitary pruning of broadleafed evergreens. Place an "F" beside each false statement.

____ 79. Dead or weak wood should be removed for appearance sake alone

____ 80. Dead or weak wood should be removed because of its effect on the future health of the plant

Part 17. List four general facts about ornamental vines.

Part 18. State four training methods for ornamental vines.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

ANSWERS TO UNIT II, LESSON 2 TEST

Part 1.

1. D
2. B
3. E
4. A
5. C
6. AB
7. AC
8. AD

Part 2.

9. T
10. F
11. T
12. F
13. T
14. T
15. T
16. F
17. T
18. T

Part 3.

19. X
20. X
21.
22.

Part 4.

23. T
24. F
25. T
26. T
27. T

Part 5.

28. T
29. T
30. F
31. T
32. T

Part 6.

33. T
34. F
35. T
36. T

Part 7.

37. T
38. F
39. T

Part 8.

40. T
41. T
42. F

Part 9.

43. D
44. AC
45. C
46. AB
47. B
48. E
49. A

Part 10.

50. B
51. D
52. C
53. AC
54. E
55. AB
56. A

Part 11.

57. F   58. T   59. F   60. T

Part 12.

61. T   62. T   63. F   64. T

Part 13.

65. T   66. T   67. F   68. T

Part 14.

69. T   70. F   71. F   72. T

Part 15.

73. T
74. F
75. T
76. T
77. F
78. T

Part 16.

79. F   80. T

Part 17. Any four of the following:

A. All vines require some kind of support
B. Most vines require some pruning to prevent tangling
C. Most vines require some pruning to get good coverage for the area
D. Some vines require no pruning except to remove diseased and injured tendrils and branches
E. Some vines are produced for vegetables, flowers for cutting, or flowers for display
F. Some vines are produced for their striking foliage, both evergreen and deciduous
G. Some vines are produced for their fruit, such as the grape

Part 18. Any four of the following:

A. Vertical support--examples: morning glories, passion vines, sweet peas
B. For fence support--attach vines to wood strips, secured with wire--any design can be achieved by pruning (head back and thin out)
C. For hinged trellises--vines attached to a framework that can be pulled back for painting walls
D. For lattice screens--vines can be pruned to be windbreaks and screens for privacy
E. For vine-draped dowel--edges of eaves can be softened by this method with proper pruning

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE EQUIPMENT

LESSON 3: SEEDING/SODDING GRASSES

LESSON OBJECTIVE

After completion of this lesson, the student will be able to IDENTIFY PARTS OF A GRASS PLANT AND WARM- OR COOL-SEASON GRASSES USING SEEDING/SODDING TECHNIQUES. Mastery will be evidenced by completion of job sheet and by scoring ________ percent on lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Define terms pertaining to seeding and sodding.
2. List four characteristics of a good seed bed.
3. Name three factors determining the depth to which a seed should be planted.
4. List the information that is required on a seed label.
5. Name two methods of seeding.
6. State four advantages to the use of mulches after seeding.
7. List four organic mulches and three inorganic mulches.
8. Identify the structure of a grass plant.
9. Name four cool-season grasses.
10. Name four warm-season grasses.
11. Perform a seeding or sodding project.

Completion of the requirements of this lesson fulfills competency J-4 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 3: SEEDING/SODDING GRASSES

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
   1. Seed label requirements
   2. Parts of a grass plant

D. Job sheet
   1. Seeding/sodding grasses

E. Lesson test

F. Answers to lesson test

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 3: SEEDING/SODDING GRASSES

INFORMATION OUTLINE

I. Terms and definitions

   A. Direct seeding--sowing the seeds into the permanent location where the grass will grow and mature

   B. Mulch--any loose material placed about the stalks of plants to protect the roots

   C. Sod--strips of grass with roots and dirt attached; sold by the square yard

   D. Plant pest--any plant, disease, or animal that causes injury to a plant

   E. Plugging--planting pieces of sod up to four inches in diameter in the ground, usually in a set pattern

   F. Sprigging--planting the rhizomes and stolons of the grass plant

   G. Stolonizing--planting the stolons of the grass plant

II. Characteristics of a good seed bed

   A. Provides good aeration

   B. Has good moisture relationship

   C. Provides good seed contact with soil particles

   D. Is free of trash

   E. Is loose but not cloddy

   F. Is level

III. Depth at which seed should be planted

   A. Depends on type of seed

   B. Depends on size of seed

   C. Depends on moisture supply

IV. Information requirements on a seed label (TM 1)

- A. Kind, variety and origin
- B. Lot number
- C. Percentage of purity
- D. Percentage of inert matter
- E. Percentage of weed seed
- F. Percentage of other seeds
- G. Percentage of germination
- H. Date of test

V. Methods of direct seeding

- A. By hand
- B. By machine (seed spreader or planter)

VI. Advantages of mulching after seeding

- A. Aids in conserving moisture
- B. Provides an insulating effect
- C. Aids in controlling weeds
- D. Adds to the soil organic material
- E. Adds nutrients to the soil
- F. Aids in controlling soil erosion until grass is mature

VII. Types of mulches that can be used effectively

- A. Organic
  - 1. Shredded bark
  - 2. Peat moss
  - 3. Straw
- B. Inorganic
  - 1. Black plastic sheet
  - 2. Stones and pebbles
  - 3. Aluminum foil
  - 4. Shredded plastics

VIII. Structure of the grass plant (TM 2)

  A. Roots
  B. Rhizomes
  C. Stolon
  D. Crown
  E. Blade
  F. Node
  G. Internode
  H. Sheath
  I. Seedhead

IX. Cool season grasses

  A. Kentucky bluegrass
  B. Perennial ryegrass
  C. Bent grass
  D. Red fescue (creeping)

X. Warm season grasses

  A. Bermuda grass
  B. St. Augustine grass
  C. Zoysia grass
  D. Bahia grass

Seed Label Requirements

GM 273

KIND	VARIETY	LOT NO.
ORIGIN		
PURITY %	WEED SEED %	INERT MATTER %
OTHER CROP SEED %		GERM DATE
GERMINATION		HARD SEED %

NAME AND NO. NOXIOUS WEEDS PER OZ.

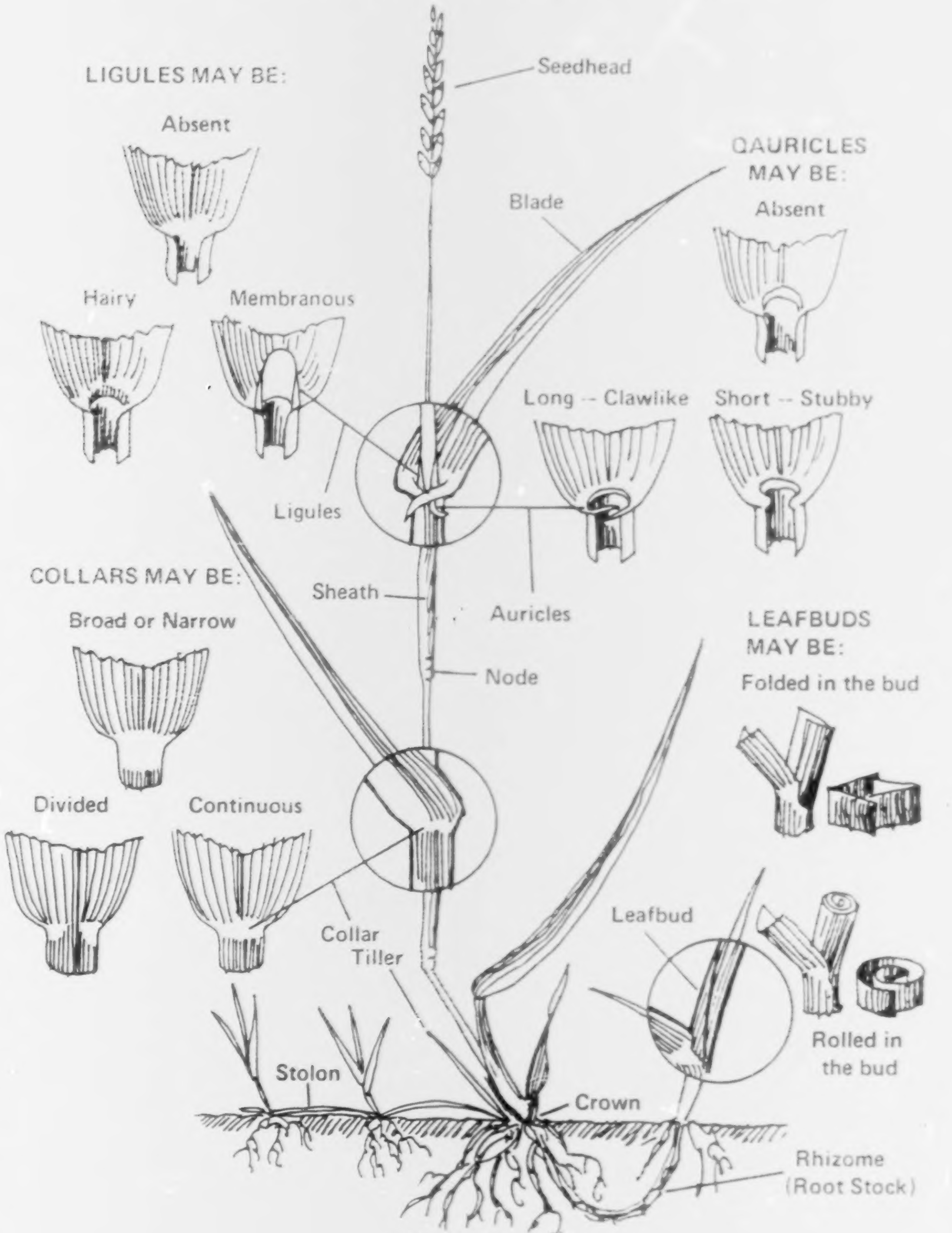
VENDOR

ADDRESS

TM 1

Parts of a Grass Plant

TM 2


LIGULES MAY BE:
Absent
Hairy
Membranous
Seedhead
Blade
AURICLES MAY BE:
Absent
Long -- Clawlike
Short -- Stubby
Ligules
COLLARS MAY BE:
Broad or Narrow
Sheath
Auricles
Node
LEAFBUDS MAY BE:
Folded in the bud
Divided
Continuous
Collar
Tiller
Leafbud
Rolled in the bud
Stolon
Crown
Rhizome (Root Stock)

GM 275

JS 1

SEEDING/SODDING PROJECT

Job sheet prepared by instructor

Equipment:

Procedure:

Evaluation
3 2 1 N

Average of above evaluations* ___ ___ ___ ___

*This average is the student's partial evaluation for competency J-4 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 3: SEEDING/SODDING GRASSES

LESSON TEST

Part 1. Match the terms below with the correct definitions.

A.	Sprigging	D.	Plant pest
B.	Direct seeding	E.	Sod
C.	Mulch		

____ 1. Sowing the seed into the permanent location where it will grow and mature

____ 2. Any loose material placed over the planted seed until it sprouts and matures

____ 3. Any plant, disease, or animal that causes injury to a plant

____ 4. Strips of grass with roots and dirt attached

____ 5. Planting the rhizomes and stolons of the grass plant

Part 2. Place a "T" on the blank beside each true statement of a good seed bed. Place an "F" beside each false statement.

____ 6. Provides good aeration

____ 7. Has no particular moisture relationship

____ 8. Provides good seed contact with the soil

____ 9. Can be loose but free of clods

____ 10. Is free of trash

____ 11. Does not need to be level

Part 3. Place the letter of the correct answer on the blank.

The factors that determine the depth at which the seed is planted are:

A. The size and type of seed
B. The moisture content
C. The time of year of planting
D. Both A and B
E. Both B and C

____ 12.

Part 4. Place an "X" on the blank beside information that is required on a seed label.

____ 13. The kind of seed

____ 14. Lot number of the seed

____ 15. Planting date for the seed

____ 16. Percent of other seeds

____ 17. Variety of the seed

____ 18. Pounds of inert matter in the seed

____ 19. Vendor name and phone number

____ 20. Percent of seed purity

____ 21. Percent of seed germination

____ 22. The amount seeds need to be watered

Part 5. Place a "T" beside each true statement. Place an "F" beside each false statement.

____ 23. The two methods of direct seeding are by hand or with a mechanical spreader

____ 24. Mulch is used to keep birds from eating the seed

____ 25. Mulch aids in conserving moisture

____ 26. Mulch provides an insulating effect from cold or heat

____ 27. Mulch is used to make the seed bed more attractive

____ 28. Mulch adds organic matter and nutrients to the soil

Part 6. Place an "X" on the blank beside each mulch that is organic.

____ 29. Shredded bark

____ 30. Black plastic sheet

____ 31. Straw

____ 32. Stones and Pebbles

____ 33. Aluminum foil

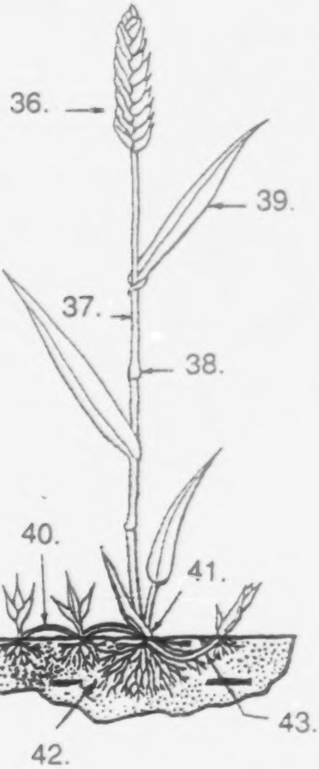
____ 34. Peat moss

____ 35. Shredded plastics

Part 7. Identify the parts of a grass plant by matching the terms below with the numbers on the illustration.

A. Roots
B. Seed head
C. Node
D. Rhizome
AB. Blade
AC. Crown
AD. Sheath
AE. Stolon

____ 36.
____ 37.
____ 38.
____ 39.
____ 40.
____ 41.
____ 42.
____ 43.



MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

ANSWERS TO UNIT II, LESSON 4 TEST

Part 1.

1. B
2. C
3. D
4. E
5. A

Part 2.

6. T
7. F
8. T
9. T
10. T
11. F

Part 3.

12. D

Part 4.

13. X
14. X
15.
16. X
17. X
18.
19.
20. X
21. X
22. X

Part 5.

23. T
24. T
25. T
26. T
27. F
28. T

Part 6.

29. X
30.
31. X
32.
33.
34. X
35.

Part 7.

36. B
37. AD
38. C
39. AB
40. AE
41. AC
42. A
43. D

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 4: MIX, APPLY AND STORE FERTILIZER

LESSON OBJECTIVE

After completion of this lesson, the student will be able to DEMONSTRATE KNOWLEDGE ABOUT FERTILIZERS, THEIR SOURCES AND FUNCTIONS; CONSTRUCT A COMPOST PILE; DETERMINE REQUIRED AMOUNT OF FERTILIZER. Mastery will be evidenced by completion of job sheet, assignment sheets and by scoring ___________ percent on the lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match terms pertaining to fertilizers with their definitions.
2. Select from given statements those that are facts about the use of fertilizers.
3. Choose correct statements about things that can happen to nutrients after they are released and are in an available form in a soil solution.
4. Choose correct statements about the ways that fertilizers improve plant production.
5. Choose correct statements about factors that determine the rate of fertilization.
6. Choose correct statements about factors to consider in choosing a fertilizer.
7. Choose correct statements about the ways that plants use the plant food elements in fertilizers.
8. Match terms and definitions pertaining to organic fertilizers.
9. Choose correct sources of soil organic matter.
10. Choose correct factors that affect the rate of decomposition of organic matter.

11. Select from given statements those that describe the effects of soil temperature on the rate of decomposition of organic material.

12. Select from given statements those that describe the effects of soil aeration and moisture on the rate of decomposition of organic matter.

13. Choose statements that accurately describe an effect of soil reaction on the rate of decomposition of organic matter.

14. Choose statements that describe the initial chemical composition of organic matter on green manure and plant residues.

15. Select true and false statements about the value and nature of humus.

16. Choose the correct C:N ratio of organic matter in the final stage of decomposition.

17. Choose correct sources of organic fertilizers.

18. Match definitions with terms that pertain to inorganic fertilizers.

19. Choose primary, secondary and trace elements in inorganic fertilizers.

20. Choose factors that#determine inorganic fertilizer selection.

21. Identify as true or false given statements concerning the features of modern inorganic fertilizers.

22. List methods of applying fertilizers.

23. List tests to determine fertilizer need and what each discloses.

24. Construct a compost pile.

25. From information given, determine the required amount of fertilizer needed on a project.

26. From information given, determine the cost of fertilizer for a project.

Completion of the requirements of this lesson fulfills competency J-6 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 4: MIX, APPLY AND STORE FERTILIZER

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
    1. Organic matter of various C:N ratios
    2. Major natural sources of one element
    3. Area divided into uniform areas for soil testing

D. Assignment sheets
    1. Determine required amount of fertilizer
    2. Determine cost of fertilizer

E. Answers to assignment sheets

F. Job sheet
    1. Construct a compost pile

G. Lesson test

H. Answers to lesson test

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 4: MIX, APPLY AND STORE FERTILIZER

INFORMATION OUTLINE

I. Terms and definitions

A. Fertilizer--a complex mixture of compounds that supply the minerals that are essential for plant growth and development

B. Commercial fertilizer--usually contains and lists N, P, and K (nitrogen, potassium and phosphate); could contain other nutrients

C. Complete fertilizer--contains all three primary nutrients (N,P,K)

D. Mixed fertilizer--contains two or more of the nutrients

E. Fertilization--applying or using fertilizers on the soil or plant

F. Analysis--an expression of fertilizer composition--All states require fertilizer manufacturers to print a guaranteed analysis or chemical composition on the fertilizer bag and/or attached tag (Analysis gives total N,P,K)

G. Grade--refers to the sum of the analysis, for example, 30 units (10-10-10); ordinary grade, less than 20 units; high grade, 20-30 units; concentrated grade, more than 30 units

H. Ratio--the proportion of the three elements (N,P,K) to one another (10-20-10 is in a ratio of 1-2-1)

I. Carrier--any material that supplies one or more of the plant nutrients--ammonium nitrate is one of the carriers for nitrogen

J. Filler--any material added to supply weight or volume--it may or may not supply nutrients, or it may act as a conditioner

K. Conditioner--any material added to a fertilizer that improves its physical condition

L. Unit--1 percent of a ton or 20 pounds

M. Colloid--a water-retaining substance

II. Some facts about the use of fertilizers

A. Plant growth removes nutrients from soil, and they must be returned by the use of fertilizers

B. When plants are supplied with an adequate nutritional level through the use of fertilizers, the quantity and quality of the plants are increased

C. The most economical means of fertilizing is to use commercial fertilizers

D. Fertilizers are used to release and supplement the essential nutrients in the soil for plant use

III. Nutrients in the soil may be

A. Absorbed by plant roots

B. Absorbed by soil organisms

C. Absorbed by soil colloids

D. Fixed in the soil

E. Lost by leaching and erosion

F. Converted and released as a gas

IV. Basic classification of fertilizer

A. Organic

B. Inorganic

V. How fertilizers improve grass/plant production

A. Increase quantity of plants

B. Increase quality of plants

C. Improve the soil

D. Replenish lost nutrients in the soil

VI. Factors that determine the rate of fertilization

A. Soil test--determines kind and quantity of nutrients present

B. Response of the plants--determines the type of fertilizer to apply

C. Kind of soil--determines retention of nutrients. For example, heavy soil retain nutrients; in light soils or sandy soils, nutrients are more susceptible to being leached out (light soils should be fertilized the most often, but in lesser amount each time)

D. Climate--determines when to apply fertilizers--for example, nitrogen should be applied early in the year because it encourages vegetative growth--nitrogen should not be applied in high amounts to tree in the fall because growth would not have time to harden off before winter

E. Cost of fertilizer--determines which to use--for example, concentrated fertilizers are usually more expensive per pound of plant food than lower grades

F. Individual user--determines use (each user has individual needs)

VII. Factors to consider in choosing fertilizers

A. The minerals that are needed

B. The method of application

C. The other effects of the fertilizer

D. The relative cost of the fertilizers

VIII. Basic ways plants use food elements in fertilizer

A. For growth (for building materials from which plants are made)

B. As catalysts (needed in order for some processes to occur)

C. To regulate pH or buffer the cell sap (this prevents sudden chemical changes in the cells)

ORGANIC FERTILIZERS

IX. Terms and definitions

   A. Green manure--soil-improving crop grown primarily to add organic matter

   B. Cover crops--soil-improving crop grown primarily to serve as a ground cover

   C. Humus--the dark brown substance resulting from decomposition, containing organic matter, giving color and other properties to soil

   D. Cation exchange--the chemical process whereby plants absorb minerals from the soil

   E. Artificial manure (synthetic)--consists of the decomposition of organic matter under more or less controlled conditions (compost)

   F. Compost--a mixture of soil and partly decayed organic matter or humus

   G. Lignin--an organic substance that, with cellulose, forms the chief part of wood tissue (40 percent to 45 percent of total humus)

   H. Lignocellulose--the substance making up the woody and fibrous parts of a plant, consisting of lignin combined with cellulose

   I. Peat--a brown, spongy, semi-granular material that is dry and easy to handle

X. Soil organic matter comes from

   A. Dead plants

   B. Animal remains

   C. Dead soil organisms

XI. Soil conditions that affect the rate of decomposition of organic matter

   A. Temperature

   B. Aeration and moisture

   C. Soil reaction

D. Initial chemical composition of organic matter

XII. Effects of soil temperature on the rate of decomposition of organic matter

A. The rate of decomposition or organic matter is at least twice as rapid at 86°F as at 68°F--and twice as rapid at 68°F as at 50°F

B. Apply organic matter more often in warm climates than in cool climates

XIII. Effects of soil aeration and moisture on the rate of decomposition of organic matter

A. Decomposition of organic matter in soils requires free oxygen and water

B. Saturated soils have inadequate quantities of oxygen--decomposition is low

C. Dry soils have inadequate quantities of water--decomposition is low

D. Moist soils have optimum quantities of both oxygen and water--decomposition takes place at its most rapid rate

XIV. Effects of soil reaction on the rate of decomposition of organic material

A. This refers to the degree of acidity in the soil

B. The degree of acidity of the soil solution influences the growth and activity of soil organisms

C. Decomposition rate is most rapid in moderately acid or slightly acid soil

XV. Initial chemical composition of organic matter

A. Green manure crops
   1. Early stages of growth contain large quantities of sugars, starches, and simple proteins--decompose rapidly
   2. Mature stage of growth contains low quantities of sugars, but large quantities of cellulose--decompose slowly

B. Plant residues, raw straw, stubble, sawdust, is made up of lignocellulose and lignin compounds that decompose slowly

XVI. Nature and value of humus

- A. Important in the cation exchange
- B. Important in phosphate availability
- C. Important in reducing aluminum toxicity in the soil
- D. Important in water-holding capacity and soil aeration

XVII. The Carbon:Nitrogen ratio (C:N) of organic matter (TM 1)

- A. When organic matter is incorporated with soil, its ratio of carbon to nitrogen is usually quite wide (example 80:1)
- B. As decomposition proceeds, large amounts of carbon dioxide are released until a ratio of 10:1 is achieved
- C. After 10:1 ration has been attained, further decomposition results stay in the same ratio
- D. Therefore, organic matter in its final state of decomposition has a ratio of 10 parts of carbon to 1 part nitrogen

  (Note: Some authorities state a ratio of C:N as 12:1)

XVIII. Organic matter production methods

- A. Compost plant residues
- B. Production of manure

XIX. Production of manure to produce organic matter

- A. Animal manure
  1. Consists of a mass of organic compounds in various states of decomposition
  2. Some of these compounds decompose slowly; others quickly
  3. Finally changes to humus
  4. Disadvantage: Takes huge quantities of manure to equal a very small amount of commercial fertilizer --for example, a ton of horse manure on the average contains about 10 pounds of nitrogen, 5 pounds of phosphoric acid, and 10 pounds of potash--this has an analysis of 0.5 percent nitrogen, 0.25 percent phosphoric acid, and 0.5 percent potash--moreover, only about one-half of the nitrogen, one-sixth of the phosphoric acid, and one-half of the potash are immediately available to plants

(NOTE: Many experiments with vegetable crops have shown that applications of moderate amounts of manure (10 to 15 tons per acre), combined with the use of commercial fertilizers (500 to 1,000 pounds per acre) have produced greater yields than the use of heavy applications of manure alone (20 to 40 tons per acre)

B. Artificial manure
  1. Various types of organic matter may be used; e.g., straw, hay, cornstalks, weeds, lawn clippings or leaves
  2. Organic matter is treated layer by layer with commercial fertilizer and lime, and may or may not be wetted down by artificial applications of water
  3. Water supply is the most important factor for the breaking down of the artificial manure for plant use

XX. Other sources of organic fertilizers

A. Peat
  1. Free from disease pests
  2. High water-holding capacity

B. Compost
  1. Mixture of soil and partly decayed organic matter (any type)
  2. Properly prepared compost is free of weeds and odor
  3. Rich in plant nutrients.

INORGANIC FERTILIZERS

XXI. Terms and definitions

A. Micro-nutrients--trace elements (minor plant foods)

B. Fertilizer--any material that supplies any essential plant food in an available form

C. Commercial fertilizer--fertilizer sold commercially containing mostly nitrogen, phosphorus, and potassium (N,P, and K) in varying proportions--occasionally contains other nutrients

D. Mixed fertilizer--contains two or more of the nutrients

E. Complete fertilizers--contain all three primary nutrients (N, P, and K)

F. Analysis--an expression of its composition--all states require fertilizer manufacturers to print a guaranteed analysis or chemical composition on the fertilizer bag and/or attached tag that gives total N, P, and K

G. Translocation--the movement or conduction of water-soluble organic materials and minerals from one part of the plant to another part

H. Respiration--the controlled breaking down or burning of glucose manufactured through photosynthesis to produce energy for plant processes

I. Chemical fertilizers--are synthesized from inorganic minerals

J. Ratio--the proportion of the primary elements (N, P, and K: 10-20-10 is 1-2-1)

K. Incomplete fertilizer--when one or two of the primary elements is missing: 0-0-10 or 10-0-0

XXII. Fertilizer nutrients

A. Primary elements
1. Nitrogen (N)
2. Phosphorus (P)
3. Potassium (potash) (K)

B. Secondary elements
1. Calcium (Ca)
2. Magnesium (mg)
3. Sulphur (S)

C. Trace elements (micro-nutrients)
1. Iron (Fe)
2. Copper (Cu)
3. Zinc (Zn)
4. Boron (B)
5. Chlorine (Cl)
6. Manganese (Mn)
7. Molybdenum (Mo)

XXIII. Effects of primary elements

A. The role nitrogen plays in plant growth
1. Produces a healthy green color
2. Induces rapid growth
3. Increases protein content of plant in absolute amounts
4. Necessary for chlorophyll manufacture

5. Deficiency symptoms:
    a. Sickly yellow-green color
    b. A distinct slow and dwarfed growth
    c. Drying up or firing of leaves that starts at the bottom of the plant and proceeds upward --the firing starts at the top of the bottom leaves and proceeds down the center along the mid-rib

(Note: An over-abundance of nitrogen leads to rank vegetative growth and tends to retard the date of plant maturity. It also contributes to danger of too high soluble content of soil solutions causing root injury and stunted plants)

B. The role phosphorus plays in plant growth
1. Stimulates easy root formation and growth
2. Gives a rapid and vigorous start to plants
3. Hastens maturity
4. Stimulates blooming
5. Appears in the transformation of insoluble carbohydrates to soluble carbohydrates
6. Deficiency symptoms:
    a. Slow growth and maturity
    b. Purplish leaves, stems, and branches

C. The role potassium plays in plant growth
1. Imparts increased vigor and disease resistance to plants
2. Essential to the formation and transfer of starches, sugars, and oils
3. Deficiency symptoms:
    a. Mottling, spotting, streaking, or curling of leaves
    b. Leaves become scorched or burned on the margins or tips
    c. Firing starts at tip of leaf and proceeds downward

XXIV. The effects of secondary elements

A. The role calcium plays in plant growth
1. Promotes early root formation and growth
2. Improves general plant vigor
3. Influences the intake of other plant nutrients
4. Deficiency symptoms:
    a. Young leaves in terminal bud become hooked in appearance and then die at the tips and along the margin
    b. Roots are short and much-branched
    c. Leaves have a wrinkled appearance

- d. Plants could exhibit deficiency symptoms of other nutrients, since the proper balance of calcium influences intake of other nutrients

B. The role magnesium plays in plant growth
  1. Essential to the formation of fats
  2. Aids in the transport of phosphorus
  3. Influences uptake of other plant nutrients
  4. Aids in translocation of starch
  5. Deficiency symptoms:
     - a. Loss of green color starting in the bottom leaves and later moves up the stalk--the veins or the leaf remain green
     - b. The plant stem is slender and weak
     - c. Leaves are mottled
     - d. Leaf tips are turned or cupped upward

C. The role sulphur plays in plant growth
  1. Promotes root growth
  2. Essential to the formation of some proteins
  3. Encourages more vigorous growth
  4. Deficiency symptoms:
     - a. The young leaves are light green in color and have even lighter veins
     - b. The stalks are short and slender
     - c. Plant growth is slow and stunted

XXV. The effects of trace elements (micro-nutrients)

A. The role boron plays in plant growth
  1. Influences water absorption
  2. Aids in translocation of sugar
  3. Deficiency symptoms:
     - a. Young leaves of terminal buds become light green at the base
     - b. In later growth, the leaves become twisted, and the stalk finally dies back to the terminal bud

B. The role iron plays in plant growth
  1. Essential to chlorophyll production
  2. Acts as an electron carrier in enzyme systems that brings about oxidation
  3. Deficiency symptoms:
     - a. The young leaves are mottled with the principal veins remaining green
     - b. The stalks are short and slender

C. The role copper plays in plant growth
  1. Acts as an electron carrier in enzyme systems
  2. Involved in plant respiration
  3. Aids in using iron

4. Deficiency symptoms:
    a. Young leaves permanently wilt without spotting or mottling
    b. The twig or stalk just below tip and seedhead is often unable to stand erect in later stages of an acute shortage

D. The role zinc plays in plant growth
  1. Involved in the formation of some growth hormones
  2. Involved in the reproduction processes of certain plants
  3. Important to plant metabolism
    a. Leaf spots that involve areas between veins and eventually involve secondary and even primary veins
    b. Leaves are thick
    c. The internodes are short

E. The role manganese plays in plant growth
  1. Essential in plant metabolism
  2. Essential for certain nitrogen transformations in plants
  3. Deficiency symptoms:
    a. Spots of dead tissue are scattered over the leaf
    b. The smallest veins tend to remain green producing a checkered effect

F. The role molybdenum plays in plant growth
  1. Acts as an electron carrier in enzyme systems that brings about oxidation reduction reaction in plants
  2. Essential to plant development and reproduction
  3. Reproduction does not take place in the absence of micro-nutrients

XXVI. Factors that determine inorganic fertilizer selection

A. Results of a soil test (send samples to local county agent)

B. Checking plant tissue material at different stages of growth

C. Type of soil

D. Cost of fertilizer

E. Method of application

F. Climate

XXVII. Features of modern inorganic fertilizers

- A. Can be compounded to satisfy different user needs
- B. Many pre-mixed commercial fertilizers available
- C. By law a guaranteed analysis or chemical composition is listed on the bag or tag
- D. Economical--effects are beneficial to growth while cost is low

FERTILIZER APPLICATION

XXVIII. Terms and definitions

- A. Starter solution--made up of chemicals that are water soluble
- B. Iron chelates--a water-soluble form of micro-nutrient used for correction of iron deficiency in crops and ornamentals in slightly acid to slightly alkaline soils

XXIX. Methods of applying commercial fertilizers

- A. Broadcast
- B. Side placement
- C. Perforated
- D. Liquid
- E. Tablet (slow release)

XXX. The broadcast method of applying fertilizer--used in fertilizing plants that are grown close together such as grass, cover plants, and in flower beds

- A. Evenly applied over the entire surface of the soil
- B. Applied after the ground is tilled

XXXI. The side placement method of applying fertilizer

- A. Fertilizer is applied in a continuous band on one or both sides, just below the seeds or plants
- B. The seedlings have a relatively large quantity of available, essential raw materials at an early stage of development

C. Small quantities of fertilizer can be used with the maximum results

XXXII. The perforated method of applying fertilizers--used for growing ornamental trees

A. Fertilizer is placed in small, drilled holes, 12 to 18 inches deep at the base of the trees

B. Tree roots receive the fertilizer; does not influence the growth of grasses and plants under the trees

XXXIII. The liquid method of applying fertilizer

A. Fertilizer is applied directly to soil

B. Fertilizer is applied as a foliage spray

C. Fertilizer is applied with irrigation water

D. Usually used to supply trace elements to secondary nutrients

XXXIV. When to use the direct soil method of applying liquid fertilizer

A. Used to supply relatively large quantities of essential raw materials close to plant roots

B. Used to supply relatively cheap source of nitrogen under certain conditions

XXXV. When to use the foliage spray method of applying liquid fertilizer

A. Used to correct a deficiency of some essential element in a relatively short time

B. Used to supply essential raw materials which, if applied to soils, would for some reason or other become unavailable to the plants

XXXVI. When to use the irrigation water method of applying liquid fertilizers

A. Used in placing fertilizer in solution with water before it is pumped through the irrigation system

B. Used in forcing a concentrated solution of the fertilizer into the irrigation lines at the time water is pumped

C. Example: Compounds that dissolve readily in water and which change to nitrate in short times are sodium nitrate, ammonium nitrate, ammonium sulfate, and urea

XXXVII. Chemical tests to determine fertilizer need

A. Soil test--determines degree of fertility of the soil

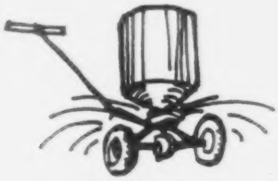
B. Plant tissue test--determines what essential elements are lacking and/or unavailable in the soil

XXXVIII. Soil Test--with results from sending a soil sample to a county agent, proper fertilizer can be selected

XXXIX. Plant tissue test--after receiving results from sending a plant tissue sample to the county agent, the proper fertilizer can be selected

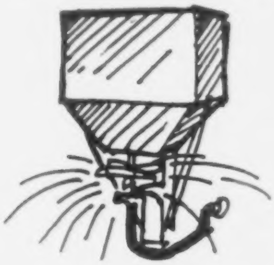
XXXX. Basic mechanical methods of applying fertilizer

A. Lawn spreader



1. Uses only pelleted or granular commercial fertilizers, seeds and pesticides
2. Area covered: six to eight feet
3. Designed for accurate, precision spreading

B. Heavy-duty spreader



1. Uses only pelleted or granular commercial fertilizers, seeds and pesticides
2. Area covered: up to forty feet
3. Designed for accurate, precision spreading

Organic Matter of Various C:N Ratios

GM 303

Organic matter low in C, high in N (a very narrow ratio)	Organic matter high in C, High in N (a narrow ratio)	Organic matter high in C, low in N (a wide ratio)	Organic matter very high in C, low in N (a very wide ratio)
Liquid manure (10:1) Legumes in early stages of growth (15:1-20:1)	Legumes in late stages of growth (20:1) Nonlegumes in early stages of growth (20:1)	Rotted straw and rotted leaves (60:1) Nonlegumes in late stages of growth (60:1)	Straw (80:1) Stubble (80:1) Strawy manure (80:1) Leaves (80:1) Sawdust (400:1) Paper (680:1)

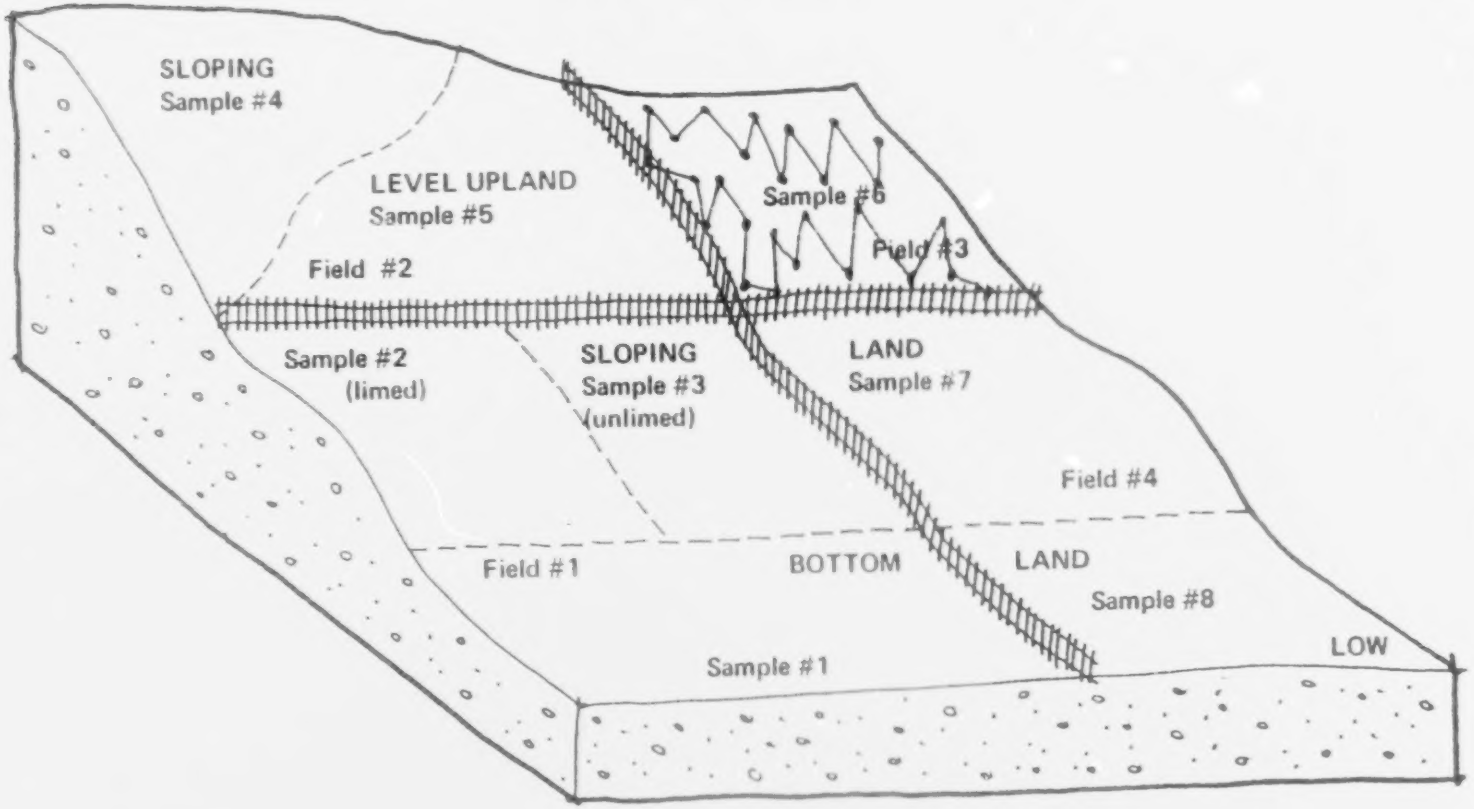
Major Natural Sources of One Element TM 2

MAJOR NATURAL SOURCES OF NITROGEN			
MATERIAL	NITROGEN %	APPLY PER 100 SQ. FT.	APPLY PER ACRE
Bloodmeal	15.0	10 oz.	265 lbs.
Felt wastes	14.0	12 oz.	285 lbs.
Hoofmeal & Horndust	12.5	13 oz.	320 lbs.
Guano	12.0	14 oz.	335 lbs.
Animal Tankage	8.0	1-1/4 lbs.	500 lbs.
Cottonseed Meal	8.0	1-1/4 lbs.	500 lbs.
Fish Scrap	8.0	1-1/4 lbs.	500 lbs.
Milogranite (activated sludge)	6.0	1-5/8 lbs.	665 lbs.
Castor Pomace	5.5	1-3/4 lbs.	725 lbs.
Bone Meal	4.0	2-1/2 lbs.	1000 lbs.
Peanut Shells	3.6	2-3/4 lbs.	1100 lbs.
Tobacco Stems or Powder	3.3	3 lbs.	1200 lbs.
Cowpea, Vetch, or Alfafa Hay	3.0	3-5/8 lbs.	1450 lbs.
Cocoa Shells	2.7	3-3/4 lbs.	1500 lbs.

MAJOR NATURAL SOURCES OF POTASH			
MATERIAL	POTASH %	APPLY PER 100 SQ. FT.	APPLY PER ACRE
Flyash	12	14 oz.	335 lbs.
Wood Ashes	8	1-1/4 lbs.	500 lbs.
Granite Dust	5	2 lbs.	800 lbs.
Seaweed	5	2 lbs.	800 lbs.
Fish Scrap, Dried	4	2-1/2 lbs.	1000 lbs.
Greensand	7	1-1/2 lbs.	570 lbs.
Tobacco Stems (Powder)	7	1-1/2 lbs.	570 lbs.

MAJOR NATURAL SOURCES OF PHOSPHORUS			
MATERIAL	PHOSPHORUS %	APPLY PER 100 SQ. FT.	APPLY PER ACRE
Phosphate Rock	30.0	3/4 lb.	270 lbs.
Bone Meal, Steamed	28.0	3/4 lb.	280 lbs.
Bone Meal, Raw	24.0	7/8 lb.	330 lbs.
Animal Tankage	20.0	1 lb.	400 lbs.
Fish Scrap, Dried	13.0	1-3/4 lbs.	675 lbs.
Basic Slag	8.0	2-1/2 lbs.	1/2 ton
Sugar Wastes, Raw	8.0	2-1/2 lbs.	1/2 ton
Incinerator Ash	5.0	4 lbs.	3/4 ton
Cottonseed Meal	2.5	8 lbs.	1-1/2 tons

Area Divided into Uniform Areas for Soil Testing


SLOPING
Sample #4
LEVEL UPLAND
Sample #5
Field #2
Sample #6
Field #3
Sample #2
(limed)
SLOPING
Sample #3
(unlimed)
LAND
Sample #7
Field #4
Field #1
BOTTOM
LAND
Sample #8
LOW
Sample #1

GM 307

TM 3

DETERMINE REQUIRED AMOUNT OF FERTILIZER

1. Given the following information, determine the amount of fertilizer needed for one acre on an acre basis
   - A. 400 pounds of nutrients wanted per acre
   - B. Percentage of nutrients in the fertilizer (20-15-5)
   - C. To cover 10 acres
   - D. Show computation
   - E. Give number of pounds needed per acre
   - F. Give number of 100 pound bags per acre
   - G. Give number of tons needed for 10 acres
   - H. Formula:

$$\text{acre basis} = \frac{\text{pounds of nutrient wanted}}{\text{percentage of nutrient in fertilizer}}$$

equals pounds needed per acre

2. Given the following information, compute the amount of fertilizer needed per square foot on the square footage basis
   - A. Nutrient rate - 25-10-5
   - B. Number of square feet - 3,000
   - C. Number of square feet per acre - 43,560
   - D. Show computations
   - E. How many pounds per square foot?
   - F. Formula:

$$\text{Square Footage Basis} = \frac{\text{(nutrient rate) (number of square feet)}}{\text{number of square feet per acre}}$$

DETERMINE COST OF FERTILIZER

1. Given the following information, calculate the cost of fertilizer per pound of nutrient.

   A. Fertilizer analysis equals pounds of nutrient per 100 pounds.

   B. Fertilizer analysis is 20-10-10.

   C. Fertilizer cost is $100.00 per ton.

   D. What is the cost per pound of nutrient? Show computations.

ANSWERS TO ASSIGNMENT SHEETS 1 - 2

Assignment Sheet 1

1. D. 1 acre = 400. = 10,000 pounds needed per acre 40%
   - E. 10,000 pounds
   - F. 100 pound bags per acre
   - G. 50 tons of fertilizer for 10 acres
2. D. 1 square foot = (40)(3,000) = 2.075
   - E. 2.075 pounds per square foot

Assignment Sheet 2

1. D. 12.5 cents--computations should be similar to the following:
   1. 20-10-10 = 40 pounds of nutrients per 100 pounds of fertilizer
   2. 20(100 pound bags)(40 pounds of nutrients) = 800 pounds of nutrients in 1 ton
   3. $100.00 per ton
   4. $100.00 divided by 800 (pounds of nutrients)= 12.5 cents per pound of nutrient

JS 1

CONSTRUCT A COMPOST PILE

Equipment:

Variety of organic material (leaves, grass clippings, sawdust, garbage)
Spade
Pitch fork
Patch of ground
Soil

Procedure:	Evaluation			
	3	2	1	N
1. Dig a pit minimum size 3 X 3 X 3 feet.	___	___	___	___
2. Make layers of organic material and soil.	___	___	___	___
3. Water thoroughly.	___	___	___	___
4. For faster decomposition, cover.	___	___	___	___
5. Turn the pile and water as needed (keep moist). Tamp lightly when watering.	___	___	___	___
6. Add organic materials as accumulated.	___	___	___	___
7. Earthworms may be added.	___	___	___	___
8. Have instructor check your work.	___	___	___	___
9. Use when desired texture is reached.	___	___	___	___
(See additional notes on next page)				
Average of above evaluations*	___	___	___	___

***This average is the student's partial evaluation for competency J-6 of Building Maintenance.**

ADDITIONAL NOTES FOR JS 1

1. Many growers prefer to keep two piles for composting, one under construction and the other ready for use.

2. Decomposition organisms are active over a wide temperature range, 40°F to 170°F--at the extremes, decomposition is low --70°F to 90°F is best.

3. To hasten decomposition, heat-generating materials (such as grass clippings or organic fertilizers) with high nitrogen content can be added.

4. Discuss the commercially prepared microorganism sources for inoculating compost pile with the instructor.

5. Compost that has been produced over a short period of time tends to have a neutral pH of 7.0--the longer it stands, the more acid it becomes (if too acid, add some lime).

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 4: MIX, APPLY AND STORE FERTILIZER

LESSON TEST

Part 1. Match the terms below with their correct definitions.

A. Complete fertilizer
B. Analysis
C. Carrier
D. Conditioner
E. Colloid
AB. Fertilizer
AC. Mixed fertilizer
AD. Filler
AE. Unit
BC. Fertilization
BD. Commercial fertilizer
BE. Grade
CD. Ratio

____ 1. A complex mixture of compounds that supply the minerals that are essential for plant growth and development

____ 2. Usually contains and lists N, P, and K (nitrogen, potassium and phosphate); could contain other nutrients

____ 3. Contains all three primary nutrients (N,P,K)

____ 4. Contains two or more of the nutrients

____ 5. Applying or using fertilizers on the soil or plant

____ 6. An expression of the fertilizer composition--all states require fertilizer manufacturers to print a guaranteed analysis or chemical composition on the fertilizer bag and/or attached tag--analysis gives total N,P,K

____ 7. Refers to the sum of the analysis, for example, 30 units (10-10-10); ordinary grade, less than 20 units; high grade, 20-30 units; concentrated grade, more than 30 units

____ 8. The proportion of the three elements (N,P,K) to one another--10-20-10 is in a ratio of 1-2-1

____ 9. Any material that supplies one or more of the plant nutrients--ammonium nitrate is one of the carriers for nitrogen

____ 10. Any material added to supply weight or volume--it may or may not supply nutrients, or it may act as a conditioner

____ 11. Any material added to fertilizer that improves its physical condition

____ 12. 1 percent of a ton or 20 pounds

____ 13. A water-retaining substance

Part 2. Place a "T" in the blank beside each statement that is a fact about the use of fertilizers. Place an "F" in the blank beside each statement that is not a fact about fertilizers.

____ 14. Fertilizers are necessary only in cloudy climates

____ 15. Plant growth removes nutrients from the soil, and they must be returned by the use of fertilizers

____ 16. When plants are supplied with an adequate nutritional level through the use of fertilizers, the quality of the plant is increased

____ 17. The most economical means of fertilization is to use natural fertilizers

____ 18. Fertilizers take excess plant nutrients from the soil to keep plants from over-growing or growing too fast

____ 19. Fertilizers are used to release and supplement essential nutrients in the soil for plant use

Part 3. Place a "T" in the blank beside each statement that is true about what can happen to nutrients after they are released and are in an available form in a soil solution. Place an "F" in the blank beside each statement that is false.

____ 20. Nutrients can be absorbed by plant roots

____ 21. Nutrients can be absorbed by soil organisms

____ 22. Nutrients can become fixed in the soil

____ 23. Nutrients lose all value once they mix with soil

____ 24. Nutrients can be lost by erosion

____ 25. Nutrients can be converted and released as a gas

Part 4. Place a "T" beside each statement that is true about how fertilizers improve plant production. Place an "F" beside each statement that is false.

____ 26. Fertilizers improve quality of plants

____ 27. Fertilizers improve quantity of plants

____ 28. Fertilizers damage the soil around the plant

____ 29. Fertilizers drain nutrients from the soil and put them in plant roots

Part 5. Place an "X" beside each factor that helps determine the rate of fertilization.

____ 30. Size of seeds

____ 31. Soil test

____ 32. Response of the plants

____ 33. Odor

____ 34. Cost

____ 35. Climate

____ 36. Needs of the individual

Part 6. Place an "X" beside each factor that helps determine type of fertilizer needed.

____ 37. Minerals needed

____ 38. Packaging

____ 39. Method of application

____ 40. Effects of the fertilizer

____ 41. Cost

Part 7. Place an "X" beside each way that plants use the nutrients in fertilizer.

____ 42. For growth

____ 43. As protection against insect pests

____ 44. To regulate the pH of cell sap

____ 45. As a catalyst for some other process

Part 8. Match the terms below concerning organic fertilizers to their correct definitions.

A. Cover crops
B. Compost
C. Cation exchange
D. Green manure
E. Artificial manure
AB. Peat
AC. Lignocellulose
AD. Lignin
AE. Humus

____ 46. Soil-improving crop grown primarily to add organic matter

____ 47. Soil-improving crop grown primarily to serve as a ground cover

____ 48. The dark brown substance, resulting from decomposition, containing organic matter, giving color and other properties to soil

____ 49. The chemical process whereby plants absorb minerals from the soil

____ 50. Consists of the decomposition of organic matter under more or less controlled conditions (compost)

____ 51. A mixture of soil and partly decayed organic matter or humus

____ 52. An organic substance that, with cellulose, forms the chief part of wood tissue (40 percent to 45 percent of total humus)

____ 53. The substance making up the woody and fibrous parts of a plant, consisting of lignin combined with cellulose

____ 54. A brown, spongy, semi-granular material that is dry and easy to handle

Part 9. Place an "X" beside each correct source of soil organic matter.

____ 55. Dead plants

____ 56. Animal remains

____ 57. Dead soil organisms

Part 10. Place an "X" beside each factor that affects the rate of decomposition.

____ 58. Soil temperature

____ 59. Soil aeration and moisture

____ 60. Soil color

____ 61. Soil reaction

____ 62. Initial chemical composition of organic material

Part 11. Place a "T" beside each true statement about Carbon:Nitrogen Ratio. Place an "F" beside each false statement.

____ 63. When organic matter is first incorporated with soil, its ration of carbon to nitrogen is usually quite wide--as much as 80:1

____ 64. As decomposition proceeds, large amounts of carbon dioxide are released until the ratio is about 50:1

Part 12. Place a "T" beside each true statement about modern inorganic fertilizers. Place an "F" beside each false statement.

____ 65. It can be compounded to satisfy different users' needs

____ 66. By law a guaranteed analysis or chemical composition is listed on the bag or tag

____ 67. In general, inorganic fertilizers are much more expensive than natural fertilizers

____ 68. Many pre-mixed commercial fertilizers are available

Part 13. List four methods of applying commercial fertilizers

Part 14. List two types of tests to determine fertilizer need.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

ANSWERS TO UNIT II, LESSON 4 TEST

Part 1.

1. AB
2. BD
3. A
4. AC
5. BC
6. B
7. BE
8. CD
9. C
10. AD
11. D
12. AE
13. E

Part 2.

14. F
15. T
16. T
17. F
18. F
19. T

Part 3.

20. T
21. T
22. T
23. F
24. T
25. T

Part 4.

26. T
27. T
28. F
29. T

Part 5.

30.
31. X
32. X
33.
34. X
35. X
36. X

Part 6.

37. X
38.
39. X
40. X
41. X

Part 7.

42. X
43.
44. X
45. X

Part 8.

46. D
47. A
48. AE
49. C
50. E
51. B
52. AD
53. AC
54. AB

Part 9.

55. X
56. X
57. X

Part 10.

58. X
59. X
60.
61. X
62. X

Part 11.

63. T
64. F

Part 12.

65. T
66. T
67. F
68. T

Part 13.

Any of the following:
A. Broadcast
B. Side placement
C. Perforated
D. Liquid
E. Tablet (slow release)

Part 14.

Soil test
Plant tissue test

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 5: WEED CONTROL

LESSON OBJECTIVE

After completion of this lesson, the student will be able to DEFINE TERMS AND STATE FACTS PERTAINING TO WEEDS AND DEMONSTRATE KNOWLEDGE OF WEED-CONTROL METHODS. Mastery will be evidenced by completion of a job sheet and by scoring _________ percent on the lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match terms pertaining to weeds and weed control with definitions.
2. List two facts about weeds.
3. Choose two correct methods of weed control.
4. Choose three correct mechanical methods of destroying weeds.
5. Identify at least three tools or machines available for mechanical weed control.
6. Identify as true or false statements concerning chemical destruction of weeds.
7. Choose three factors on which a weed-control program depends.
8. Name two types of compounds used in a herbicide weed-control program.
9. Choose from given statements those that apply to selective herbicide compounds.
10. Select from given statements those that apply to selective herbicide compounds.
11. Identify as true or false statements concerning steps in pre-emergence weed-control treatments.
12. Identify as true or false statements concerning steps in post-emergence weed-control treatments.

13. Name two types of noxious weeds.
14. Perform a mechanical weed-control task.

Completion of the requirements of this lesson fulfills competency J-7 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 5: WEED CONTROL

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
   1. Some broadleaf weeds and 2, 4-D control
   2. Broadleaf weeds

D. Job sheet
   1. Mechanical weed control

E. Lesson test

F. Answers to lesson test

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 5: WEED CONTROL

INFORMATION OUTLINE

I. Terms and definitions

   A. Herbicides--substances that kill vegetation

   B. Perennial weeds--plants that live more than two years but may produce seeds for new plants each year

   C. Biennial weeds--plants that require two years to complete a life cycle

   D. Summer annuals--weeds that germinate in the spring from seed and mature in summer or fall each year

   E. Winter annuals--weeds that germinate in fall or late winter and mature in late spring

   F. Pre-emergence--herbicide treatments applied before weeds sprout from seeds

   G. Post-emergence--herbicide treatments applied after weeds appear

   H. Noxious weed--a plant that causes injury to a crop plant

   I. Weed--any plant that is growing where it is not wanted

II. Facts about weeds

   A. Weeds compete with garden plants and turf for water, nutrients, and space

   B. Weeds harbor insects and sometimes spores of plant diseases

III. Basic methods of weed control

   A. Mechanical destruction

   B. Chemical destruction

IV. Mechanical methods of destroying weeds

A. Hand pulling--used when weeds are growing among choice, shallow-rooted plants

B. Hoeing and cultivating--used for destruction of weeds in relatively large areas

C. Flaming--used before weeds have developed fully

V. Tools and machines used for mechanical destruction of weeds

A. Common garden hoe--used for flower beds and around ornamentals

B. Cultivating forks (different sizes)--used for little garden plants and shrubs

C. Scuffle hoes (flat-bladed, disk type, or U-shaped)--used in close quarters or under spreading plants

D. Rotary tilling and dicing--used in larger gardens, flower beds or vacant lots
1. Especially effective where there are no summer rains to germinate late weed crop
2. They knock down weeds and incorporate them into the soil where they decay and form humus

E. Weed burners--used for flaming

F. Mulch--used to prevent weed growth

VI. Chemical destruction of weeds

A. Used to reduce labor cost

B. Sprayer should be clearly marked as to content and used only for weed killing

C. Weed killers called herbicides are toxic

D. Chemicals can selectively kill germinating or recently germinated weeds in turf

E. With chemicals there is a risk of damaging other desired forms of plant life

F. With chemicals there is a likelihood that they won't work

G. Timing is of critical importance for each of these materials

VII. What a program of weed control depends upon

  A. Frequency with which crops of weeds become established

  B. Amount of top and root growth of the adjacent plants

  C. Soil type

VIII. Types of compounds used in a weed-control herbicide program

  A. Compounds that are nonselective in action

  B. Compounds that are selective in action

IX. Non-selective herbicide compounds for weed control

  A. Are toxic to all plants

  B. Examples of non-selective herbicides that kill the whole plant: lead arsenate, calcium arsenate, borax, sodium chloride, and ammonium sulfamate (called Ammate)

  C. An example of a non-selective herbicide that defoliates (destroys top growth)--paraquat

  D. Advantages and disadvantages--one compound may be more effective and desirable or used under one set of conditions, and another compound may be more effective and desirable under another set of conditions

X. Selective herbicide compounds for weed control (TM 1)

  A. Are toxic to certain kinds of plants and do very little, if any, damage to other kinds
    1. Toxic--kills the protoplasm by direct chemical action (example: Ansar 529)
    2. Growth regulators--induce an abnormal development of certain tissues (example: 2, 4-D)

XI. Steps in pre-emergency weed-control treatments

  A. Prepare the land to receive the seed

  B. The weed seed germinates, absorbs the herbicide, and dies

  C. The crop seed is planted and the herbicide is applied

  D. Advantage: Herbicide is applied when the weed seedlings are very susceptible to injury

E. Disadvantage: Heavy rains may leach the herbicide to the vicinity of the seed, and thus could retard or prevent germination of the crop seed--also, most perennial weeds are not susceptible to pre-emergence herbicides

XII. Steps in post-emergence weed control treatments

A. Crop seed is planted immediately after the land is prepared

B. Herbicide applied when the crop plant is established

C Advantage: Possible injury to the germinating seeds is avoided

D. Disadvantage: Mature weed plants may be quite resistant to the effects of the herbicide since mature tissues are more resistant than immature tissues--also, there may be some damage to future crops from herbicide residue

XIII. Types of noxious weeds (TM 2)

A. Grassy weeds (monocots)
   1. Examples: barnyard grass, crab grass, foxtail, goose grass, witch grass, bent grass, coarse fescue, quack grass, rye grass, timothy

B. Broadleaf weeds (dicots)
   1. Viney type: clover, excalis, bindweed
   2. Rosette type: plantain, dandelion

TM 1

Some Broadleaf Weeds and 2, 4-D Control

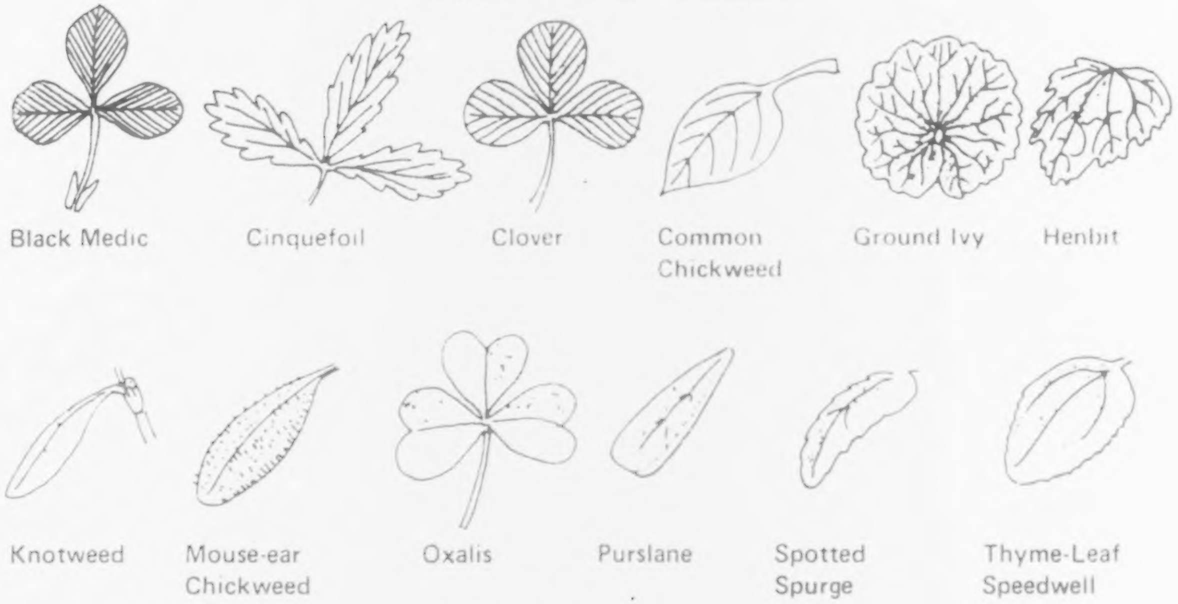
WEEDS	LIFE SPAN	2, 4-D CONTROL
Bindweed	Perennial	Repeat
Black Medic	Annual	One application
Buckhorn	Perennial	One application
Chicory	Perennial	Repeat
Common Chickweed	Annual	One application
Mouse-Ear Chickweed	Perennial	One application
Clover	Perennial	One application
Dandelion	Perennial	One application
Curly Dock	Perennial	One application
Ground Ivy	Perennial	One application
Heal-All	Perennial	One application
Henbit	Annual	One application
Knotweed	Annual	One application
Lambsquarters	Annual	One application
Mallow	Perennial	Repeat
Mustard	Perennial	
Peppergrass	Annual	One application
Pigweed	Annual	One application
Plantain	Perennial	One application
Purslane	Annual	One application
Ragweed	Annual	Repeat
Sheep Sorrel	Perennial	One application
Shepher's Purse	Annual	One application
Smartweed	Annual	Repeat
Spotted Spurge	Annual	No selective control
Texas Blueweed	Perennial	Repeat
Thistle (Canada)	Perennial	Repeat
Yellow Rocket	Biennial	One application

Check with instructor on control of narrow-leaf (monocot) weeds.

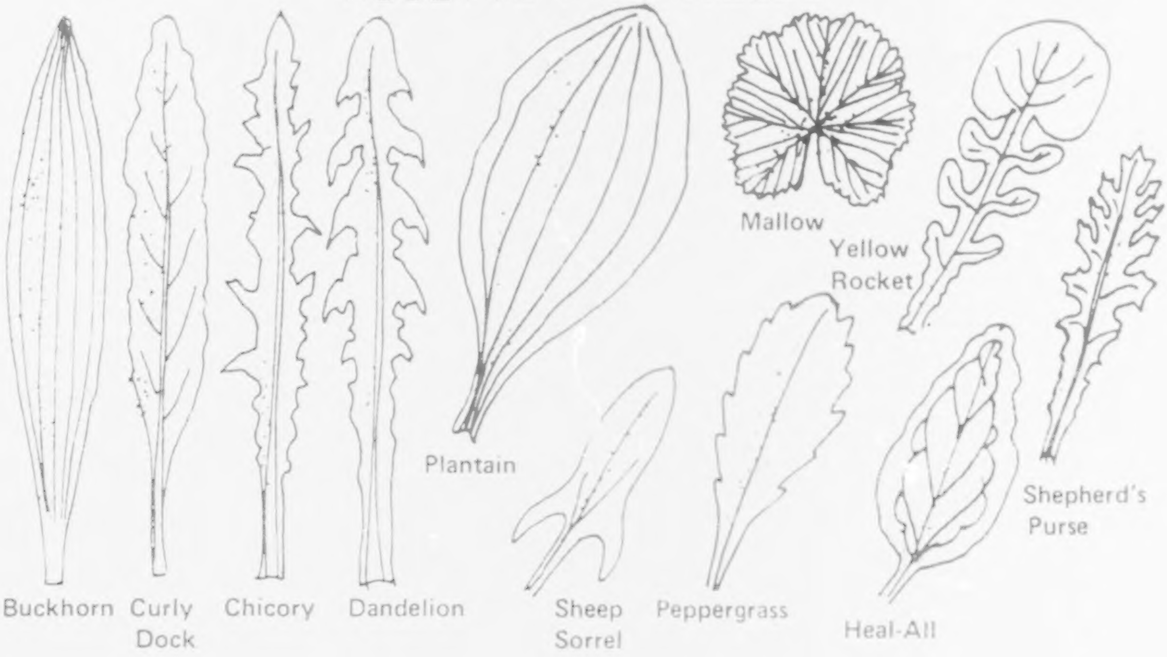
Broadleaf Weeds

TM 2

VINEY TYPE WEEDS


Black Medic
Cinquefoil
Clover
Common Chickweed
Ground Ivy
Henbit
Knotweed
Mouse-ear Chickweed
Oxalis
Purslane
Spotted Spurge
Thyme-Leaf Speedwell

ROSETTE TYPE WEEDS


Mallow
Yellow Rocket
Plantain
Shepherd's Purse
Buckhorn
Curly Dock
Chicory
Dandelion
Sheep Sorrel
Peppergrass
Heal-All

MECHANICAL WEED CONTROL

Equipment:

Common garden hoe
Scuffle hoe
Cultivating fork
Rotary tiller/disc
Weed burner

Instructor to design project and specify procedures

Procedure	Evaluation 3 2 1 N

Average of above evaluations* ___ ___ ___ ___

*This average is the student's partial evaluation for competency J-7 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 5: WEED CONTROL

LESSON TEST

Part 1. From the list below choose two types of noxious weeds. Place their letters in the blank.

A. Semi-annuals
B. Broadleaf weeds
C. Perennials
D. Summer annual
E. Grassy weeds

____ 1. Herbicide treatment applied before weeds sprout from seeds

____ 2. Any plant growing where it is not wanted

____ 3. Weeds that require two years to complete a life cycle

____ 4. Substance that kills vegetation

____ 5. Weeds that germinate in the fall or late winter and mature in spring

Part 2. Match the term below with their correct definitions.

A. Perennial
B. Noxious weed
C. Post-emergence
D. Summer annuals

____ 6. Herbicide treatment applied after weeds appear

____ 7. A plant that causes injury to a crop plant

____ 8. Weeds that germinate in spring from seed and mature in summer or fall

____ 9. Weeds that live more than two years, but may produce seeds for new plants each year

Part 3. Place a "T" in the blank beside each true statement. Place an "F" in the blank beside each false statement.

____ 10. Weeds do not compete with garden plants and turf for water, nutrients and space

____ 11. Weeds harbor insects and spores of plant diseases

____ 12. The two methods of weed control are mechanical and chemical

____ 13. Chemicals are seldom used to destroy weeds because their application increases labor costs

____ 14. Chemical sprayers should be clearly marked as to content and used only for weed killing

____ 15. Weed-control chemicals never damage the crop plant

____ 16. Sometimes chemicals don't work

____ 17. Timing of chemical application for weed control is not important

Part 4. Place an "X" beside each fact that a weed-control program depends upon.

____ 18. Frequency with which crops of weeds become established

____ 19. The time of year

____ 20. The type of soil

____ 21. The amount of rainfall

____ 22. The type of control being used

____ 23. The amount of top and root growth of adjacent plants

Part 5. Choose the best response to complete the statement.

____ 24. The two types of herbicide compounds used in weed control are:

A. selective and non-selective
B. pre-emergence and post-emergence
C. liquid and dry powder
D. none of the above

Part 6. Place an "X" beside each statement that applies to non-selective herbicide compounds.

____ 25. Are toxic to all plants

____ 26. One compound may be more effective and desirable under one set of conditions and another compound may be more effective and desirable under another

____ 27. They do not kill plants

____ 28. Some examples of herbicides that kill the whole plant are lead arsenate, calcium arsenate, and sodium chloride

____ 29. An example that defoliates only is Paraquat

Part 7. Place an "X" beside each statement that applies to selective herbicide compounds.

____ 30. Are toxic to certain kinds of plants

____ 31. Do very little damage to some plants

____ 32. They kill the protoplasm by direct chemical action

____ 33. They do not induce abnormal growth in plant tissue

Part 8. Place an "X" in the blank beside each true statement about pre-emergence weed control treatments.

____ 34. Used in the fall of the year

____ 35. Used before the seedling plant emerges

____ 36. The weed seed germinates, absorbs herbicide, and dies

____ 37. The chemical is applied as the seed is planted

____ 38. The weed seedling is not susceptible to injury

____ 39. Heavy rains may leach the chemical to the vicinity of the crop seed and retard its growth

Part 9. Place an "X" in the blank beside each true statement about post-emergence weed-control treatments.

____ 40. Used after the seedlings of the crop plant have emerged

____ 41. Seed is planted as soon as the land is prepared

____ 42. Chemical is applied when the crop plant is in the seedling stage

____ 43. Crops plant germinating seedling can avoid being injured

____ 44. Weed plants do not become resistant to the chemicals used

Part 10. From the list below choose two types of noxious weeds. Place their letters in the blanks below.

A. semi-annuals
B. broadleaf weeds
C. perennials
D. summer annual
E. grassy weeds

_____ 45.

_____ 46.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

ANSWERS TO UNIT II, LESSON 5 TEST

Part 1.

1. D
2. E
3. A
4. B
5. C

Part 2.

6. C
7. B
8. D
9. A

Part 3.

10. F
11. T
12. T
13. F
14. T
15. F
16. T
17. F

Part 4.

18. X
19.
20. X
21.
22.
23. X

Part 5.

24. A

Part 6.

25. X
26. X
27.
28. X
29. X

Part 7.

30. X
31. X
32. X
33.

Part 8.

34.
35. X
36. X
37. X
38.
39. X

Part 9.

40. X
41. X
42. X
43. X
44.

Part 10. B and E

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 6: MIX, APPLY, AND STORE PESTICIDES

LESSON OBJECTIVE

After completion of this lesson, the student will be able to DEMONSTRATE KNOWLEDGE OF SELECTION AND USE OF CHEMICAL PESTICIDES and BE ABLE TO MIX, APPLY AND STORE PESTICIDES PROPERLY. Mastery will be evidenced by completion of job sheet and by scoring __________ percent on lesson test.

SPECIFIC OBJECTIVES

In completing this lesson, the student will:

1. Match definitions with terms that relate to pesticides and safety.
2. Identify as true or false statements concerning stomach-and-contact poisons.
3. Identify as true or false statements concerning contact poisons.
4. Identify as true or false statements concerning systemic poisons.
5. Identify as true or false statements concerning fumigants.
6. Identify as true or false statements concerning seed and seed-stock treatment materials.
7. Identify as true or false statements concerning fungicides and/or bactericides.
8. Identify as true or false statements concerning antibiotics.
9. Choose factors to consider when selecting a pesticide.
10. Choose factors to consider when handling and mixing pesticides.
11. Identify as true or false statements concerning applying pesticides.

12. Identify as true or false statements concerning proper methods of storing pesticides.

13. List three ways to dispose of surplus pesticides and containers.

14. Mix, apply and store a pesticide according to manufacturer's recommendations.

Completion of the requirements of this lesson fulfills competency J-8 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 6: MIX, APPLY, AND STORE PESTICIDES

CONTENTS OF LESSON

A. Objectives

B. Information outline

C. Transparency masters
   1. Chemical composition of important pesticides (excluding herbicides)
   2. Key words on labels
   3. Proper spray clothing
   4. A sample label

D. Job sheet
   1. Mix, apply and store pesticides

E. Lesson test

F. Answers to lesson test

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 6: MIX, APPLY, AND STORE PESTICIDES

INFORMATION OUTLINE

I. Terms and definitions

   A. Pesticide--generic name for all chemicals that kill plant pests at some stage of their life cycles

   B. Fungicide--generic name for all chemicals that kill fungi

   C. Systemic action--translocation of a pesticide from one part of a plant to another, affecting the toxic action throughout the system of the plant

   D. Toxic--poisonous

   E. Nematode--a very small round worm that lives in the soil and frequently enters the plants through the roots

   F. Herbicide--a chemical substance used to kill herbaceous plants

   G. Antidote--a substance used to counteract the effect of poisons

II. Chemical compounds classified according to toxic effect

   A. Stomach-and-contact poisons (insecticides--kill either by affecting stomach or by contact)

   B. Contact poisons (insecticides--kill by contact only)

   C. Systemic (kill by entering plant, and exerting control in the plant conducting system)

   D. Fumigants (gasses that kill by stopping respiration of insects and nematodes)

   E. Seed and seed-stock treatment materials (applied to seeds, tubers, bulbs and flesh roots--kills fungi or bacteria cells)

   F. Fungicides and bactericides (applied to plant surface to inhibit growth of spores, fungi or bacteria cells)

   G. Antibiotics (applied in solution--kills fungi)

H. Herbicides (used to kill herbaceous plants)

III. Facts about stomach-and-contact poisons

A. Used for the control of insects with either chewing or sucking or rasping mouth parts

B. Some poisons are rotenone, chlordane, dieldrin, lindane, malathion, methoxychlor, parathion, and pyrethrum products

C. Pyrethrum products are nonpoisonous to man can be expensive

IV. Facts about contact poisons

A. Used to control insects with sucking or rasping mouth parts

B. Poison penetrates through the insect body directly or through the breathing or sensory pores

C. Some poisons and how used--nicotine sulfate for the control of many kinds of aphids--aramite for the control of phosphate-resistant red spider mites--and oil emulsions for the control of scale and mealybugs

V. Facts about systemic poisons

A. Chemical compounds that enter the conducting systems of plants

B. They may be applied as a foliage spray or to the soil

C. Most effective against insects with sucking or rasping mouth parts

D. Since systemic are highly poisonous to man, their use is usually limited to non-edible crops such as cotton and crops grown for their flowers

E. Some examples of systemic are Demeton and OMPA or Pestox-3

F. Nonstemics--main action is to coat the plant--some of the chemicals are absorbed by the plant, however

VI. Facts about fumigants

A. Chemical compounds that change from either the solid or liquid form to the vapor or gaseous form

B. These gases stop the respiration of insects and nematodes and enter the cells of fungi and bacteria

C. They can be applied to the soil or to crops growing in greenhouses or similar structures

D. Chemicals applied to the soil are chloropicrin, methyl bromide, Nemagon, Vapum, and VC-13

E. Chemicals applied to crops inside enclosures are aerosols of dithio compounds, parathion, malathion, and TEPP

VII. Facts about seed and seed-stock treatment materials

A. Chemical compounds that are applied to the surface of seeds, tubers, bulbs, and fleshy roots

B. Used to protect young plants against certain types of fungi or bacteria that would otherwise damage or destroy them

C. Applied in carefully measured doses that kill the cells of the bacterium or fungus and at the same time do no damage to the seedling plants

D. Some examples of the chemicals are mercuric chloride, Captan, Chloronil, Diclone, and thiram

VIII. Facts about fungicides and/or bactericides

A. Chemical compounds used to prevent or inhibit the growth of germinating spores, mycelium or fungi, or the cells of certain bacteria on surface of the plant

B. Once these organisms have successfully invaded the tissues, the use of the compounds is not effective--timing of the application is essential

C. Application to outdoor crops should be made just before a rain, rather than after

D. Some examples are copper sulfate and fresh hydrated lime in a suspension with water, commonly called Bordeaux mixture; quick lime and sulfur in solution with water; colloidal (or wettable) sulfur; sulfur dust; and the dithiocarbamates--Dithane, Fermate, Manate, Parzate, Captan, Mildex, and Cyprex

IX. Facts about Antibiotics

A. Antibiotics are definite chemical compounds that are made by a given organism for its protection against disease-producing organisms

B. For example: The fungus Penicillium-notatum makes and secretes the antibiotic penicillin for protection against its bacterial enemies--in other words, the penicillin kills the invading bacteria

C. Experiments by plant scientists have shown that antibiotics are effective against certain diseases caused by fungi

D. They are systemic in action

E. They are applied in a solution of water and are absorbed into the plant sap

F. Examples of antibiotics used to control certain plant disease are streptomycin, streptomycin-terramycin, and Actidione

X. Factors to consider when selecting pesticides

A. Identify the pest to be controlled--if in doubt, consult County Extension Agent or other agricultural agencies

B. Be sure the pesticide is recommended by a competent authority for the particular problem

C. The pesticide label will contain the name of the pest to be controlled, and the crop, animal, or place of intended use

D. Determine the active ingredient and the proper mixing and application procedures

E. Follow and heed all warnings and cautions

F. Since pesticide labeling sometimes changes, be sure the pesticide label is up-to-date

G. The use of persistent pesticides may limit the crops that can be grown in that soil the following season

H. Purchase only amounts needed for a single season to reduce storage and possible disposal problems

XI. Factors to consider when handling and mixing pesticides

A. Read label directions and current recommendations carefully before mixing--note all warnings and cautions before opening container

B. Wear suitable protective clothing and equipment as specified on the label

C. Open pesticide containers carefully to avoid dust or splashing

D. Measure accurately, using proper equipment--do not use containers or measuring tools used for food, beverage, feed or seed

E. Pesticides should be handled in a well-ventilated area, preparing no more than will be used in one day

F. Watch out for wind! When pouring or mixing, avoid having dust blow or splash back in the face or on your body

G. Don't mix pesticides near wells, streams, or ponds where there is a chance that spills or overflows will get into water supply

H. Clean up spills immediately--wash pesticides off skin promptly with plenty of water and soap--change clothes if pesticides are spilled on clothing

I. Avoid working with pesticides alone--call your doctor if there is any doubt about your contact with the pesticide

(Note: Highly toxic insecticides such as TEPP, Demeton (Systox), Endrin, Parathion, Mevinphos (Phosdrin), Phorate (Thimet), Dithiodemeton (Di Syston), and Guthion should be applied only by persons thoroughly familiar with their hazards and who will comply with all precautions!)

XII. Some factors to consider when applying pesticides

A. Keep accurate records of applications; include date, specific area, and amount used

B. Calibrate application equipment carefully and frequently during the season

C. Replace leaky hoses and connections

D. Follow the manufacturer's directions exactly

E. To protect honeybees, do not spray plants in bloom with insecticides--notify neighbors at least 48 hours before spraying so that they can protect their bees

F. Don't use mouth to blow out clogged lines or nozzles

G. Minimize drift by applying on a calm day

H. Clean all equipment used in mixing and applying pesticides

XIII. How to dispose of surplus pesticides and containers

A. Neutralize the poisonous effect of the pesticide if there are directions on the label for doing so

B. Don't dump into a sewage system or street gutter that drains into open water

C. Don't drain the sprayer near a well, pond, or stream

D. Don't discard pesticide or containers where soils, crops, water, or animals will be contaminated

E. Puncture or crush metal containers (except aerosol) and bury in an isolated area or land-fill dump--do not burn

XIV. Proper methods for storing pesticides

A. Store in the original, labeled containers--NEVER in food or drink containers

B. Discard unidentified pesticides

C. Store in a dry well-ventilated room or building away from food, feed, or seeds--liquid pesticide should be stored in heated areas to prevent freezing

D. Make sure storage area is secure from children, irresponsible persons, pets, and livestock--keep storage area locked--never store in medicine cabinets or under the kitchen sink

E. Be sure caps are secure on bottles or cans and check regularly for leaks

F. Do not store volatile weed killers such as 2,4-D and related herbicides with other wettable powders, dust, or seeds

XV. Basic pesticide-application equipment

A. Power sprayer

B. Compound air sprayer

C. Trombone sprayer

D. Mist blower

E. Various size dusters

F. Aerosol bombs

G. Fumigant containers

H. Liquid drenches

I. Fogger

J. Complete set of protective clothing

Chemical Composition of Important Pesticides

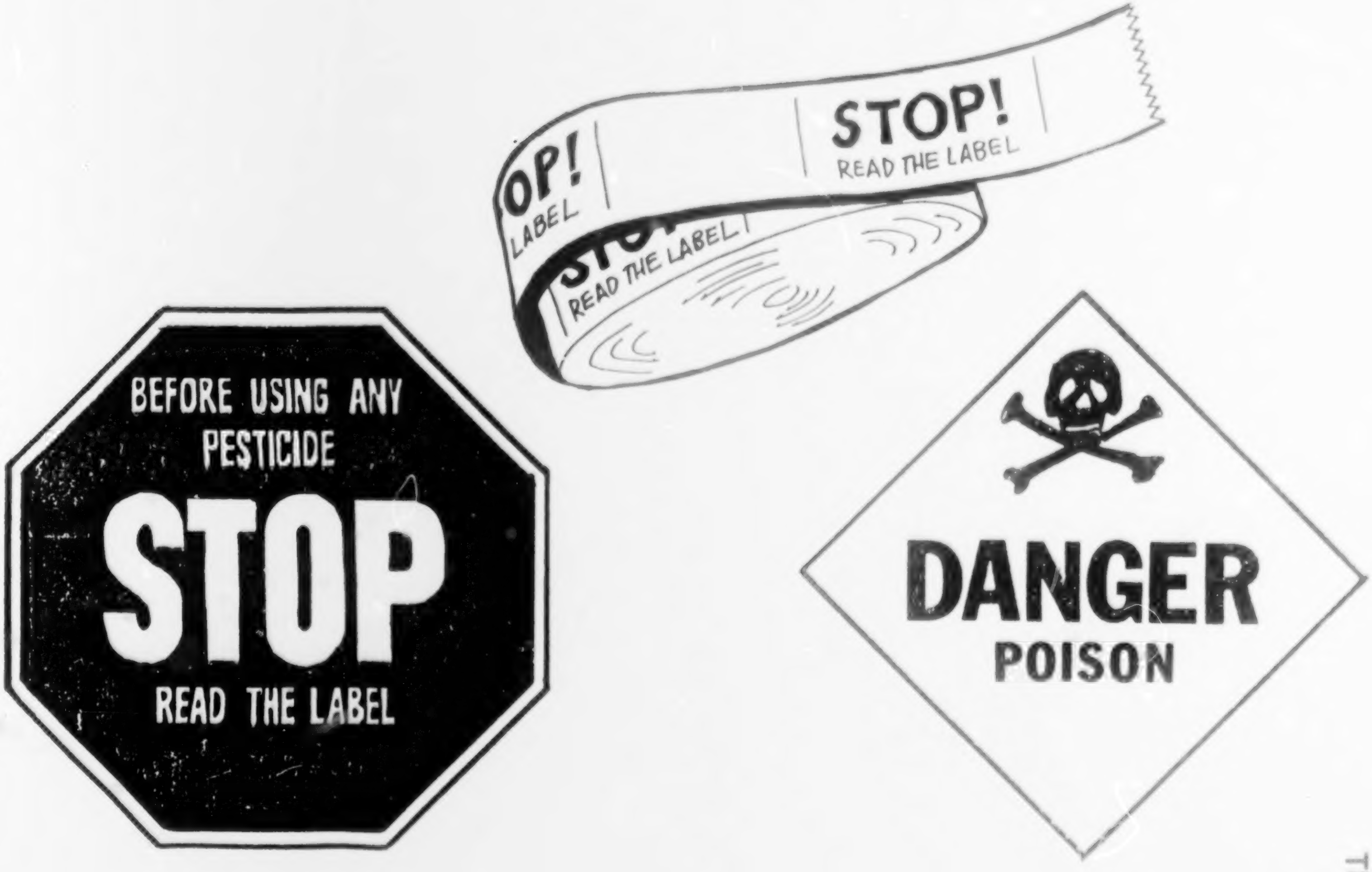
(Excluding Herbicides)

CLASS OF MATERIAL	SPECIFIC EXAMPLE	MAJOR TYPE OF ACTION
Organic (Naturally occurring)		
antibiotics	streptomycin	bactericide
nicotine	nicotine sulphate	insecticide
pyrethrum		insecticide
rotenone		insecticide
oils	diesel oil	insecticide
Synthetic		fungicide
carbamates	ferbam	fungicide
	sevin	insecticide
chlorinated hydrocarbons	DDT	insecticide
	DD	nematocide
mercury compounds	Ceresan, Semesan	fungicide, bactericide
organophosphates	malathion	insecticide, miticide
phthalimides	captan, phaltan	fungicide
pyrethrins		insecticide
Inorganic		
arsenic	lead arsenate	insecticide
copper	copper sulfate	fungicide, bactericide
mercury	mercuric chloride	fungicide, bactericide
sulfur	lime sulfur	fungicide

GM 357

TM 1

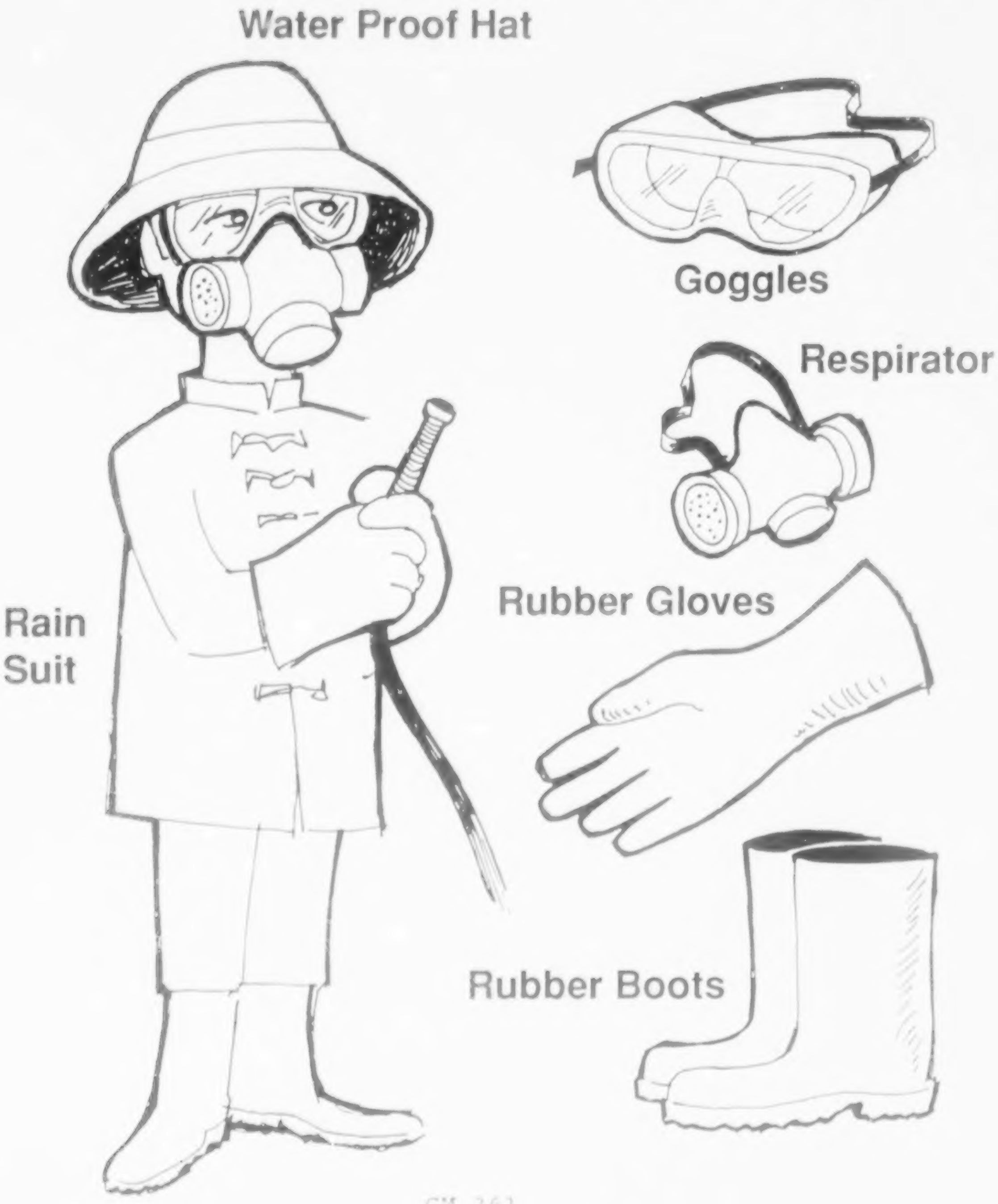
Key Words on Labels


STOP!
READ THE LABEL
OP!
LABEL
STO
READ THE LABEL
BEFORE USING ANY PESTICIDE
STOP
READ THE LABEL
DANGER
POISON

GM 359

TM 2

Proper Spray Clothing


Water Proof Hat
Goggles
Respirator
Rain Suit
Rubber Gloves
Rubber Boots

A Sample Label

Diazinon®

Insecticide AG500

SAMPLE LABEL

For control of insects on fruits, nuts, vegetables, field crops, and ornamentals

Active Ingredients:	**84%**
O,O-diethyl O-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothiate	48%
Xylene	36%
Inert ingredients:	**16%**
Total:	**100%**

Diazinon AG500 contains 4 lbs. Diazinon per gallon.

Warning:

Keep out of reach of children. **May be fatal if swallowed. May be absorbed through the skin. Do not breathe spray mist. Do not get in eyes, on skin, or on clothing. Wash thoroughly after handling. Avoid contamination of food and feed. Keep out of reach of domestic animals. Do not use on humans, household pets, or livestock. Do not permit children or pets to go on to sprayed grass until spray has completely dried.**

Fish and Wildlife Caution:
This product is toxic to fish and wildlife. Birds feeding on treated areas may be killed. Keep out of lakes, streams or ponds. Apply this product only as specified on this label.
This product is highly toxic to bees exposed to direct treatment or residues on crops. Protective information may be obtained from your Cooperative Agricultural Extension Service.

Do not reuse empty container. Destroy it by perforating or crushing. Bury or discard in a safe place.

Minimum Flash Point: 82°F.
Do not use or store near heat or open flame.

EPA Reg. No. 100-461 AA

Geigy

DIRECTIONS FOR USE AND CONDITIONS OF SALE AND WARRANTY

IMPORTANT: Read the entire Directions For Use and the Conditions Of Sale And Warranty before using this product.

Conditions Of Sale And Warranty

The **Directions For Use** of this product reflect the opinion of **experts based** on field use and tests. The directions are believed to be reliable and should be followed carefully. However, it is impossible to eliminate all risks inherently associated with use of this product. Crop injury, ineffectiveness or other unintended consequences may result because of such factors as weather conditions, presence of other materials, or the manner of use or application all of which are beyond the control of Geigy or the Seller. All such risks shall be assumed by the Buyer.

Geigy warrants that this product conforms to the chemical description on the label and is reasonably fit for the purposes referred to in the **Directions For Use**, subject to the inherent risks referred to above. **Geigy makes no other express or implied warranty of Fitness or Merchantability or any other express or implied warranty.** In no case shall Geigy or the Seller be liable for consequential, special or indirect damages resulting from the use or handling of this product. Geigy and the Seller offer this product, and the Buyer and user accept it, subject to the foregoing Conditions Of Sale And Warranty which may be varied only by agreement in writing signed by a duly authorized representative of Geigy.

JS 1

MIX, APPLY AND STORE PESTICIDES

CAUTION: Instructor must be present
Use proper safety equipment and clothing

Instructor will choose type of pesticide and area to be treated. Procedures for this job sheet will follow manufacturer's instructions.

Equipment:

Sprayer/duster
Mixing or agitating tool
Mixing container
Pesticide

Safety equipment/protective clothing:

Goggles
Rubber gloves
Hat
Respirator
Rubber boots
Rain suit or equivalent

Procedure:	Evaluation 3	 2	 1	 N
1. Mix pesticide.	___	___	___	___
2. Apply pesticide.	___	___	___	___
3. As directed by instr[illegible], prepare remaining pesticide for dispos[illegible] storage.	___	___	___	___
4. As directed by instructor, prepare for next job sheet or clean up area and return tools and materials.	___	___	___	___
Average of above evaluations*				

*This average is the student's partial evaluation for competency J-8 of Building Maintenance.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

UNIT II: GROUNDS MAINTENANCE PROCEDURES

LESSON 6: MIX, APPLY, AND STORE PESTICIDES

LESSON TEST

Part 1. Match the terms below with their correct definitions.

A. Nematode
B. Pesticide
C. Systemic action
D. Toxic
E. Fungicide
AB. Antidote

____ 1. Poisonous

____ 2. Very small roundworm that lives in the soil and frequently enters the plants through the roots

____ 3. Translocation of a pesticide from one part of the organism to another, affecting the toxic action throughout the organism's system

____ 4. A substance used to counteract the effect of poisons

____ 5. Generic name for all chemicals that kill fungi

____ 6. Generic name for all chemicals that kill plant pests at some stage of their life cycle

Part 2. Place an "X" in the blank beside each true statement concerning stomach-and-contact poisons.

____ 7. Used for the control of insects with either chewing or sucking or rasping mouth parts

____ 8. Some poisons are: rotenone, chlordane, dieldrin, lindane, malathion, methoxychlor, parathion, and pyrethrum products

____ 9. Pyrethrum products are nonpoisonous to man

____ 10. Pyrethrum is very inexpensive

Part 3. Place an "X" in the blank beside each true statement concerning contact poisons.

____ 11. Used to control insects with sucking or rasping mouth parts

____ 12. Poisons penetrate through the insect body directly or through the breathing or sensory pores

____ 13. Nicotine sulfate is used for the control of many kinds of aphids

____ 14. Aramite is used for the control of phosphate-resistant red spider mites

____ 15. Oil emulsion is used for the control of scale and mealybugs

Part 4. Place an "X" in the blank beside each true statement concerning systemic poisons.

____ 16. Systemic poisons are non-chemical compounds that enter the soil to make it pliable

____ 17. Systemic poisons may be applied as a foliage spray or to the soil

____ 18. Use of systemic poisons is limited to nonedible crops

____ 19. Systemic poisons are chemical compounds that enter the conducting systems of plants

Part 5. Place an "X" in the blank beside each true statement concerning fumigants.

____ 20. Fumigants are chemical compounds that change from either the solid or liquid form to the vapor or gaseous form

____ 21. Fumigants stop the respiration of insects and nematodes and enter the cells of fungi and bacteria

____ 22. Fumigants are never applied to the soil or crops growing in a greenhouse

____ 23. Fumigant chemicals applied to the soil are chloropierin, methyl bromide, Nemagon, Vapam, and VO-13

____ 24. Aerosols can be used in an enclosure

Part 6. Place an "X" in the blank beside each true statement concerning seed and seed-stock treatment materials.

____ 25. Seed and seed-stock materials are chemical compounds that are applied to the surface of seeds, tubers, bulbs, and fleshy roots

____ 26. Seed and seed-stock materials do not protect young plants against certain types of fungi or bacteria

____ 27. Seed and seed-stock materials, applied in carefully measured doses, kill the cells of bacteria or fungi and at the same time do no damage to seedling plants

____ 28. Some examples of seed and seed-stock chemicals are mercuric chloride, Captan, Chloronil, Diclone, and thiram

Part 7. Place an "X" in the blank beside each true statement concerning fungicides and/or bactericides.

____ 29. Fungicides and/or bactericides are used to prevent or inhibit the growth of germinating spores, mycelium of fungi, or the cells of certain bacteria on the surface of the plant

____ 30. Once enemy organisms have successfully invaded plant tissue, the use of fungicides and/or bactericides is ineffectual

____ 31. The timing of the application of fungicides and/or bactericides is not important

____ 32. Application of fungicides and/or bactericides should be made just before a rain

____ 33. Bordeaux mixture is made from copper sulfate and fresh hydrated lime in a suspension with water

Part 8. Place an "X" in the blank beside each true statement concerning antibiotics.

____ 34. Antibiotics are definite chemical compounds that are made by a given organism for its protection against disease-producing organisms

____ 35. The fungus Penicillium-motatum makes and secretes the antibiotic penicillin for protection against its bacterial enemies

____ 36. Antibiotics are effective against certain diseases caused by fungi

____ 37. Antibiotics are non-systemic in action

____ 38. Antibiotics are applied in a solution of water and are absorbed into the plant sap

Part 9. Place an "X" in the blank beside each true statement concerning the application of pesticides.

____ 39. Keep accurate records of applications

____ 40. Calibrate application equipment carefully and frequently

____ 41. Replace leaky hoses and connections

____ 42. Manufacturer's directions are the same for all pesticides

____ 43. To protect honeybees, do not spray plants in bloom

____ 44. Don't use mouth to blow out clogged lines or nozzles

Part 10. Place an "X" in the blank beside each true statement concerning proper methods of storing pesticides.

____ 45. Store in original, labeled container

____ 46. Discard unidentified pesticides

____ 47. Store in a dry, well-ventilated room away from food, feed, or seeds

____ 48. Liquid pesticides can be frozen

____ 49. Make sure storage area is secure from children

____ 50. Keep storage area locked

____ 51. Do not store volatile weed killers with other wettable powders, dust or seed

Part 11. Name at least four factors to consider when selecting a pesticide.

____

____

____

____

Part 12. Name at least five factors to consider when handling and mixing pesticides.

Part 13. List three ways to dispose of surplus pesticides and containers.

MODULE: GROUNDS MAINTENANCE EQUIPMENT AND PROCEDURES

ANSWERS TO UNIT II, LESSON 6 TEST

Part 1.

1. D
2. A
3. C
4. AB
5. E
6. B

Part 2.

7. X
8. X
9. X
10.

Part 3.

11. X
12. X
13. X
14. X
15. X

Part 4.

16.
17. X
18. X
19. X

Part 5.

20. X
21. X
22.
23. X
24.

Part 6.

25. X
26.
27. X
28. X

Part 7.

29. X
30. X
31.
32. X
33. X

Part 8.

34. X
35. X
36. X
37.
38. X

Part 9.

3[illegible]. X
40. X
41. X
42.
43. X
44. X

Part 10.

45. X
46. X
47. X
48.
49. X
50. X
51. X

Part 11. Any four of the following:

A. Identify the pest to be controlled. If in doubt, consult County Extension Agent or other agricultural agencies.

B. Be sure the pesticide is recommended by a competent authority for the particular problem.

C. The pesticide label will contain the name of the pest to be controlled, and the crop, animal, or place of intended use.

D. Determine the active ingredient and the proper mixing and application procedures.

E. Follow and heed all warnings and cautions.

F. Since pesticide labeling sometimes changes, be sure the pesticide label is up-to-date.

G. The use of persistent pesticides may limit the crops that can be grown in that soil the following season.

H. Purchase only amounts needed for a single season to reduce storage and possible disposal problems.

Part 12. Any five of the following:

A. Read label directions and current recommendations carefully before mixing. Note all warnings and cautions before opening container.

B. Wear suitable protective clothing and equipment as specified on the label.

C. Open pesticide containers carefully to avoid dust or splashing.

D. Measure accurately, using proper equipment. Do not use containers or measuring tools used for food, beverage, feed or seed.

E. Pesticides should be handled in a well-ventilated area, preparing no more than will be used in one day.

F. Watch out for wind! When pouring or mixing, avoid having dust or splashback blown in face or on your body.

G. Don't mix pesticides near wells, streams, or ponds where there is a chance that spills or overflows will get into water supply.

H. Clean up spills immediately. Wash pesticides off skin promptly with plenty of water and soap. Change clothes if pesticides are spilled on clothing.

I. Avoid working with pesticides alone. Call your doctor if there is any doubt about your contact with the pesticide.

Part 13. Any three of the following:

A. Neutralize the poisonous effect of the pesticide if there are directions on the label for doing so.

B. Don't dump into a sewage system or street gutter that drains into open water.

C. Don't drain the sprayer near a well, pond, or stream.

D. Don't discard pesticide or containers where soils, crops, water, or animals will be contaminated.

E. Puncture or crush metal containers (except aerosol) and bury in an isolated area or land-fill dump. Do not burn.